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LECTURE.

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SURGEON-GENERAL JAMES MOUAT, M.C., C.B., in the Chair.

SUGGESTED IMPROVEMENTS IN SANITARY ARRANGEMENTS FOR HOSPITALS, BARRACKS, CAMPS, AND SHIPPING, &c.

By Major-General MILLINGTON SYNGE, Royal Engineers.

WHEN I received the honour of an invitation from the Council to address you on the subject selected for our meeting to-day, I could not question the intention that I should bring before you that particular branch of sanitary law with the importance of which I have been so much convinced, as to have in the first instance warmly pressed its consideration on various departments of the public service, and subsequently re-directed the aim what might remain of the energy of my life into a new direction and a fresh field.

Damp, cold, and vitiation are the three prominent evil agencies we, in this climate, have more especially to guard against. An abode, then, of whatever nature, in which any of us are to dwell, be it hospital, camp, barrack, or ship, should be supplied with dry, warm, and pure atmosphere. The true test, therefore, of the relative merit of all structural or mechanical arrangements of whatever kind, is the measure in which they may succeed or fail in conveying to us warmth, dryness, and freedom from contamination. I must not now dwell at any length upon these points; but I leave you to judge how far we have observed these extremely simple and elementary obligations in sending our artificial warmth up chimneys—except when these send us down the cooled carbon, and obstinately refuse to draw, and instead of fulfilling their intended office, go near to have us stifled and smothered—or in underlaying our ground floors with receptacles of the utmost possible revolting description of contents, the receptacles themselves being out of view and beyond access, the only thing known of them being that it is absolutely out of the question they should be anywhere

perfect except under a combination of fortuitously favourable accidents, on which it were sheer folly to base any rule of conduct or practice.

I must, however, invite your careful attention to the distinction between *Sanitary Law* and such changes or caprices as are apt to be given the name of *Sanitary Improvement*, and are often advanced by what in reality is penal legislation, waged (incautiously, it may be, but still waged) against all laws of health. The distinction is a wide and most important one. Law may be violated, but it remains law, be it never so much set at defiance, even by legal enactments. In like manner we may be absolutely certain, by analogy alone, that there is in all matters, but one law of health, and *that*, let us treat it as we may, remains unaltered and unalterable, terribly vindicating its infraction, or rewarding its observance by a decree of life or of death. I shall have to revert more fully to this branch of the subject presently; meanwhile I will ask you to bear in mind that if the law be violated, ending of the violation will be a great improvement in the state of affairs, and in individual conduct; but to pretend to improve what is in its very essence a violation of law, is of the nature of an absurdity. Framed in conformity with law (the unalterable law governing created matter), sanitary arrangements admit of constant improvement, but arrangements conflicting with sanitary law, are incurably vicious. *Insanitas* is not far from insanity, and it may be an interesting, and might prove a profitable investigation, to trace how near may be the connection between the *mens insana*, the diseased mind, and the neglect of natural law in the healthful preservation of the body.

Our condition—I mean the stage at which we have arrived in this matter—is aptly illustrated in the words we use. We term arrangements sanitary, merely because they deal with matters which affect the state of the general health, and not at all necessarily implying that they deal with them beneficially: nay, often their force lies in exactly an opposite direction. To bring the laws of health before you in an apt and striking manner, I purpose calling your attention in the first place to those cases which most palpably and largely affect the state of general health, namely, hospitals for infectious cases.

Happily, it is not necessary to argue out here, or in the present day, that the germs of disease are destructible by the agency of fire; nor that, on the contrary, water serves as a vehicle for the widest possible dissemination of such germs; but I will bring before you some striking evidence, both as to principle and practice, illustrative of these facts. Water—water in any form, rendered the vehicle of contagion—carries those germs directly in its own body, serves to evaporate them into the air, serves to impregnate the surface soil with them, and, receiving the inoculation of the corrupting process instituted, multiplies them perpetually, and spreads them irresistibly.

I have sought now for some considerable time how most effectively to bring this most important aspect of the wide subject under the direct cognisance of all the bodies, governmental, municipal, and voluntary, that have the control of hospitals, and I look upon the present opportunity of specially inviting to it the attention of the Army and Navy Medical Departments, through the medium of the present lecture,

as a most important step in that direction. In a paper read at the last meeting of the Social Science Congress, at Norwich, I pointed out that whereas it was incontestibly established that the contents of sewers served to generate corrosive gases strong enough to eat through lead, and poisonous enough to kill, it has been proved as certainly, that the germs of disease may be entirely destroyed by resorting to the agency of fire. I also stated that if any means could hold such germs in a latent and harmless condition, short of their destruction by fire, that agency was to be found in charcoal, which application has now for a very considerable time past been carried out in the Infectious Hospital, as well as in the Convalescent Hospital in the city of Glasgow.

Dr. Russell, the health officer of the city of Glasgow, on my proposal that burning works, according to Mr. Stanford's system for dealing with such matters (for the discovery I have taken up is his), should be put up in all hospitals throughout the kingdom, or in groups receiving infected contents in receptacles hermetically sealed for conveyance to such central depôts, writes as follows:—

1. "No hospital should discharge into public sewers. They [that is "infectious materials] should be destroyed as regards possibility of "reaching the community.

2. "If General Synge can get his proposal adopted, it would answer "this end *perfectly*."

He also states,—"For my own part I believe that, however it acts, "charcoal in sufficiency disorganises every organic structure involved in "it, and infecting organisms among the rest, and consequently do not "see any need for keeping infected from innocent matter, *both being* "*carbonised*."

Writing on the same subject, Dr. Andrew Feargus, of Glasgow, whose scientific labours, both in research and publication, have contributed much to advance a more correct appreciation of the true merits of this question, states,—

1. That impurities from diseased patients produce like diseases, by tainting the air and water, and that decomposition increases this power very much.

2. That he holds all such matter injurious to health, if it is allowed to decompose.

3. That the present system of water carriage causes decomposition in the sewers.

4. That all matter of the kind referred to should be subjected to to chemical or other action, rendering decomposition impossible.

Lastly, he writes, "I have observed the carbon process for years, and "highly approve of it, as it meets every sanitary requirement, inas-"much as it prevents the decomposition, and as both are subjected to "a red heat, it follows that all germs of disease, and organic matter of "every kind, must be thoroughly destroyed."

Major-General Scott, than whom few have given more careful consideration to the subject, says,—

"The expediency of re-carbonization during the prevalence of dis-"ease cannot be questioned. The combustion would destroy all possi-"bility of spreading infection."

Going beyond the question of hospital application, General Scott, referring to localities limited by certain conditions, adds,—

"The material which Mr. Stanford has introduced, and his method "of re-carbonization, . . . would contribute towards a scientific "and economical solution."

Upon this broader basis I take the following extract from the *Oldham Chronicle* of the 20th December last (1873):—

"Dr. Sutton (the health officer of the borough) reported that he "accompanied the Chairman and Vice-Chairman (of the Sanitary Com- "mittee) to Glasgow, where they inspected the system of deodorization "carried on. The report was exceedingly satisfactory."

In another number of the same paper appears the following amusing, but at the same time instructive, comment:—

"At the close of the ordinary business the Committee entered upon "a minute and interesting examination of several bottles of 'inodorous' "[contents]. When the bottles were placed, the demand so common "at this festive season to 'hand a bottle round' was urgently and "persistently made, and one member of the Committee, in his admira- "tion, described the affair as a grand Christmas treat."

It is important to bear in mind, especially in connection with hospital treatment, that the medium which, so to speak, takes the infectious danger into custody and will not permit it to carry out its intended ravages, is in itself wholly inoffensive, perfectly inodorous and perfectly manageable, and as superior in the sick room to any other possible application, as it is in the prevention of farther contamination.

There are, therefore, clearly two rival agencies that may be resorted to in order to remove the impurities attaching to the sick room and hospital, from one locality to another. The one prevents the dissemination of infection and enables the germs of disease to be absolutely destroyed. By means of the other, on the contrary, nausea may be actively created throughout the whole range of hospital buildings, or of any other buildings or persons having unhappily to contend with personal or other sickness. Infection may, moreover, be spread over an indefinite area and by intangible means. Air and water may be corrupted beyond calculation and measure, by a pestilential and putrifying foulness, carrying with it everywhere the seeds of premature decay and death.

Let me sketch for you at somewhat greater length the action and characteristic marks of these contending forces.

I should scarcely need to remind you of the chemical constituents of water, were it not for their qualities being palpably either overlooked or set at utter defiance when its proper sphere of purification is neglected and it is thrust into that province of nature in which transmutation is indispensable before there can be restitution. By evaporation, the constituents of water are, as we are taught, perpetually ascending into the atmosphere, whence they are from time to time perceptibly, and, I believe, always more or less, precipitated. A very ready and effective means therefore of viciously impregnating the atmosphere, as well as water itself, is found in the pollution of water.

Substances hurrying to putrefaction when thrown into water neces-

sarily give rise to the formation of particular well-known offensive gases, which vary in malignity up to the point which is fatal to human life. The flow of water is irresistible and endless, excepting that of such portions as rise by direct evaporation or become transmuted by gradual absorption into, and are taken up by, mineral, vegetable, or animal life. Putrefying substances thrown into water *corrupt* it, and the flow of putrefaction is accordingly irresistible, and it is incurable, except by chemical agency.

In the one case we have therefore an agency offensive, and, but for an assumed (but an erroneously assumed) necessity, an intolerable agency introduced into the sick room, where it is difficult of application and disgusting in practice. It is improper chemically, and therefore very wrong in application. It immediately sets in increased action every ingredient that carries peril with it outside of the infected sick room. From the first moment of the unjustifiable admixture it becomes impossible altogether to arrest its action, or to say where or when the ill is ended or has been cured. Nor does the ingenious elaboration of mischief, artificially contrived, end here. The laws which matter obeys, are not lightly set at defiance, and their pacification is not easily effected. This one act of an originally thoughtless and wrongful admixture leads step by step to an all but irremediable condition. Human perversity has made this false step obligatory. Legal enactments, acting by virtue of the majesty of law, have singled out the area within which this wrongful course could work the most disastrous consequences, and instead of ordering that the voluntary putrefaction of water and the thereby debarring others from its application to its primary and proper purposes, should be punishable in conformity with law, these legal enactments have, on the contrary, *compelled* the corrupt abuse of water contrary to all law, and contrary to all science, whether chemical, economical, or moral.

I shall content myself upon this head with the words of Dr. Letheby, and only venture to add that the vengeance nature takes, does not confine itself to figures of arithmetic, although the ineffectual attempt to repurify the water wantonly and uncleanly corrupted in the United Kingdom would cost, I believe a sum that would seem to you utterly incredible.

But in this selfish and perverse misapplication of that which was given us to assuage thirst and in which to wash our bodies, our clothing, and our dwellings, we have not only deliberately and intentionally disregarded the cardinal rule of our duty to our neighbour, but we have installed in our homes and houses the confederate of cholera, of typhoid fever, and of all other forms of infectious disease. In populous localities we only open our windows to escape from the fœtid odours we have introduced into our houses, it may be to let in the breath of death, which we call ventilation. Moreover, this misapplication of water proves as costly as untrustworthy. From the plumber's corroded or bursting pipe to the builder's drain failing in its level, it is an endless harassing of never effectual repairing. Lastly, the legal tyranous enactment which forces their whimsical combinations of stupidity and deadly danger on us, finally mocks us with commands, first to corrupt the

water supplies of the kingdom, and then to keep them out of the channels of those waters.

Dr. Letheby only says too truly (we put a final question),—

"Whether the present system with the agency of water has not "created more waste and greater sanitary danger and more expensive "litigation than any other system which the ingenuity of man could "have devised? Not forgetting that the water which is thus waste- "fully and irreparably fouled amounts to from 20 to 30 gallons per "head of the population daily, and has been brought at great cost "from the purest sources, and perhaps filtered in the most careful "manner. What other nation would have been guilty of such "folly?"

If you should be inclined to think I have wandered too much aside from my immediate subject of the military and naval application and bearing of this flagrant abuse, let me venture to remind you that legislation for the metropolis not only might be supposed to embody the results of the most matured consideration and of the most decided approval, but in the case of England, the metropolis is the key and heart of all the empire, and its position in relation to the empire deserves fully as much consideration in a military, as in any other aspect. Besides, it furnishes me with the most striking illustration I could have brought before you of the consequences of that reprehensible act which, with the bigotry that seems inseparable from folly, has made compulsory within its limits, this foul misuse of water.

In an amusing, but extremely pertinent speech before the Philosophical Society of Glasgow, Mr. Stanford lately said, "The city of "Glasgow was about to apply to the city of London for advice in sani- "tary matters. Before doing so, would it not be worth while to inquire "what the city of London had done in the matter? The city of "London drank the diluted sewage of about half-a-million of inhabi- "tants who resided above her, and she was allowed to pour her "sewage in one unpurified flood at the doors of her neighbours below "her."

Such are the characteristics, such the results of the one system. This is the result to which sanitary legislation has been led by contracted views, looking only to self, and so to being driven into all manner of acts carrying with them dire retribution. This it is to sink in moral sense so low as to pour the most revolting contamination possible into the drinking draught and washing portion of your neighbour. Vicious and unclean, ruinous and deadly.

The other agency, charcoal, is, in all respects, opposite to this. I have already briefly sketched its action, and need only remind you of the testimony already brought before you as to its purity and perfect sanitary attributes. As to its application in a sick room, it is unnecessary to add a single word to this assurance that, used in due quantity, it necessarily carries with it an entire absence of odour, is a complete absorbent, is (as we have been told), a safeguard against infection, and acts mechanically as a perfect carrier.

The first point, therefore, on which in summing up this portion of my subject I would here insist is—

That it is WRONG to remove the corrupting impurities in question by water, and this especially in the case of all hospitals, but most particularly so wherever infectious diseases occur.

Secondly. That it is RIGHT to provide for the use and application of charcoal in all such cases, whereby, first, cleanliness, comfort, and purification are given in the sick room, or ward, or bay; and whereby the spread of infection is guarded against, and all possibility of the same may be destroyed by the agency of fire, a matter of vital importance to all, inasmuch as, unfortunately, none of us carries with him an immunity from suffering, infection, or death.

I shall scarcely need, I think, after the very conclusive evidence, as it appears to me that I have been enabled to bring before you, to dwell at very great length on that which seems to follow irresistibly, viz., that that which is incontestibly best for all cases of sickness carries with it a strong presumption of universal superiority. The case is palpably not quite so strong or so imperative either in merit or demerit in general practice as in special disease; but after all, possibly, quantity in this case may fully compensate for any diminution in intensity.

For my own part, I should prefer to put the matter on its true footing, and to let it rest on that. I believe it incontestibly wrong, wantonly and selfishly to corrupt one of the indispensable sustainers of human life. I say we may not, and WE SHOULD NOT DARE to pass on our defilement to mingle with our neighbour's drink, nor with the means of his personal ablution. And with the manifest proof of the wrong, the evil ought to cease.

Western nations—and our own, I fear, is no exception—pay, however scant regard to man's primary obligations, be they never so fastidious, as to philosophical or metaphysical crotchets, or philanthropists of that fashion I have heard defined as *men* so busy about people's faults they quite forget their own. At all events, within the metropolitan area, military hospitals and barracks are alike compelled to spread pollution in this matter, and I cannot, therefore, well omit the subject, and I must now bring before you the broader of the grounds for abandoning a course which, I have no hesitation in saying, were it not in actual constant practice among us, would better entitle its advocate to a place of punishment than to admission among men capable of distinguishing between right and wrong.

Are you disposed to believe that I exaggerate, being led away by concentrated attention to a particular subject? If so, let me pray you picture the position I should stand in before you if, instead of pleading the cause of neighbourly consideration, I had to argue in behalf of the practice that obtains. How could I reply to such questions as the following?

You propose, then, to put a corrupting substance into water?—I do. You know that will disengage dangerous gases?—I do. You know these are corrosive enough to eat through lead?—I do. You propose to make an inlet for these gases in every dwelling?—No, a great many more than one. You shall not open a window without a chance of such an inlet, and you shall not lay a floor, nor build a wall without a chance of the kind.

You propose pouring in one concentrated flood all infectious matter into these common and communicating receptacles?—I do. You then propose to pass on the fœtid air pestilence-breeding contents into the rivers to mingle it may be with the drink and washing portion of your neighbours?—I propose making this absolutely certain. Can you form any estimate of the expense of the course you propose?—Yes, tolerably; I should get rid of a gross value of about £15,000,000 per annum on the population of the United Kingdom, and it would cost me not much more than a capital outlay of £1,320,000,000 to do so effectually all over the kingdom. Does this include any provision for re-purifying the water you corrupt, or do you know of any effective means for effecting such re-purification?—As to the first part of your question, certainly not; as to the latter, there are chemical means of re-purification, but they involve such an outlay as would ultimately ruin anybody resorting to them. Then you propose, first, an act of indecency and neighbourly disregard, in reality, therefore, an act of personal uncleanness, an act chemically vicious as well as dangerous to health, and ruinously extravagant in itself, besides its waste of a material renovant in nature.—All this I do propose. Does not an act of such extreme disregard of neighbourly duty approach to an act of indecency and uncleanness?—That is for you to say.

Have I overdrawn this picture? Not by intention, certainly. The course I have after all inadequately described, forms the scope and operation of one of the most popular panaceæ, namely, an act of compulsory legislation, an act of the Parliament of the 19th century.

The *Times*, ever vigorous in counselling compulsion and Government interference, wrote, in apprehension of an outbreak of cholera:—

"In the first place, the destruction of the infectious matter from "cholera patients must be insisted on under the heaviest penalties, "and a system of inspection adequate to enforce this provision must "be organised. Without these preliminary safeguards we cannot hope "to resist the enemy with any success. So long as the germs of the "disease are allowed to pass through the sewers into the rivers, to be "washed up by the tide against our seaside villages, to be wafted about "our streets in the form of an impalpable dust, we cannot hope for any "good results from sanitary measures of the ordinary kind. Cleanli-"ness, ventilation—above all a pure water supply, are advantages "which cannot be over-valued. But until the germs of disease are "systematically destroyed and excluded from any chance of mingling "with the air we breathe and the water we drink, nothing will control "the ravages of cholera. Every other precaution is subordinate to the "main preventive measure, which it will need special powers to carry "into effect—the destruction of the cholera germs before their "diffusion."

Perfectly true of the whole subject; but the childish feebleness, the aged impotence or mental imbecility that can see no remedy except in perpetual recommendations of penal or compulsory legislation, are possibly more to be deprecated than even death from preventible disease. They are the pallor and paralysis of the soul and spirit.

The cure, once for all, of many errors would be never to interfere by

legal enactment positive, but to adhere to negatives. Sanitary law would then be simply,—You may *not* pour corrupted water into rivers. You may *not* release destructive gases into the atmosphere. It would abstain from first compelling the corruption to be set up.

I base all proposals for dealing with the scientific substitution of a proper vehicle to take the place of water on Mr. Stanford's dictum, which I hold to be correct, viz., "We ought to seek a disinfectant which will add as little as possible to bulk," and I should myself add to weight. In other words we should endeavour to reverse the course we have pursued. In lieu of adding liquid to what liquid causes to putrify, we should endeavour to solidify by drying and imprisoning foul substances. A very preponderating and by far the most troublesome portion of human waste is not in a dry condition. Therefore whilst in charcoal there is an agent of indisputably perfect efficacy, the efficacy of that agent is increased as well as made more and more available the more the drying process is favoured and accelerated. The application of charcoal to liquids may be of two kinds, either by sufficiency in quantity to absorb, when it practically is made to act something like a mop, or the liquid may be strained through charcoal, or a combination of charcoal with other suitable chemical or mechanical agents, until a degree of purity is attained that renders the liquid flowing off harmless.

In the abstract, and from an exclusively sanitary point of view, the former is, I presume, incontestibly superior; but in practice, the latter may prove so thoroughly adequate to most, if not to all occasions, as to render it preferable on account of its far greater convenience and economy.

That such a mode exists I am confidently led to believe, and I have no doubt the full merits of the subject in this aspect will in due time be brought forward by Major-General Scott—to whom I have had already to refer—the discoverer of this valuable mode of assisting the great principle of abstaining from water abuse.

My object, however, in mentioning this double mode at the present time, is to show that we are in possession of more than one method by which a perfect sanitary result may be ensured. The *Pall Mall Gazette* of the 27th January, 1874, writes as follows on the sanitary value of the agency of fire in the prevention of contagion and disease:—

"The 'cremation' of our own remains is not a matter of more "importance than the cremation of the less romantic refuse which "chokes the dust-bins of our houses. Here at least there can be no "sentiment to interfere with the annihilation of rubbish injurious to "health, and any one who suggests an effectual plan for reducing it to "harmless atoms will deserve well of his country, and rank among its "benefactors. It is a mistake to suppose that the injurious effects of "the accumulated rubbish of our houses cease when the dust-bin is "emptied, and the dust contractor has at last kindly consented to "perform the service for which he is paid. The dust thus carted "away returns to us in another shape. Dr. Corner, the medical officer "of Mile-end Old Town, in his recent report on the condition of the "dwellings of the poor in the district under his charge, points out the

"intimate relation between houses and the health of their occupants, "and calls attention to the well-known fact that the contents of dust-"bins are mostly used in the manufacture of bricks, &c. If these "contents were composed of ashes only, no danger need be feared, but "it is, says Dr. Corner, a question whether the baking process always "destroys any deleterious ingredients. The truth is that little else but "ashes should be placed in dust-bins; all other refuse capable of "'cremation' should be at once destroyed by fire. In the meantime "there is a class of rubbish, such as the old materials from fever dens, "which ought beyond question to be immediately burned. Under "present arrangements these materials may, observes Dr. Corner, be "used with impunity in the erection of new houses, and 'thus ensure "'an early outbreak of fever.'"

Compelled as I am by limits of time wholly to pass by many interesting points connected with this subject, and to touch on others only very lightly, I will conclude with a very brief summary of the mode in which charcoal has been applied, in order first to prevent contagion; and, secondly, to destroy, by the combustion of the germs, the possibility of contagion spreading.

Mr. Stanford, to whom we are indebted for this discovery, says:—

"I employ, by preference, seaweed charcoal, because it is the "most porous, the best absorbent, and the cheapest. It only re-"quires one-fourth of the weight, compared to earth, and when "the mixture is removed and placed under cover, it soon dries." This mixture can be stored for any length of time and used again several times. When convenient it is re-burned, like the char in sugar refineries, except that this process is carried out in apparatus which admits of collecting the ammonia and other products condensed. The whole of the ammonia is thus collected; whilst the phosphoric acid, potash and mineral matters accumulate in the charcoal, together with the carbon from the organic constituents of the excreta. The weight of the charcoal is increased to the extent of about 5 per cent. with each using, and if dried and re-used five times, about 25 per cent. with each re-burning. With this constant addition, the char does not require replacing with fresh material, so that its cost is only a primary outlay—the ultimate result being that the excreta is deodorised by a charcoal derived from itself, and a company working this process would, in addition to securing the whole of the ammonia, become sellers of a charcoal second only in value to that from bones to the extent of, in Glasgow, if the process were general, 19 tons a-day, or 6,935 tons a-year, the total quantity of excreta which Glasgow has to remove being 385 tons a-day, and its value at £1 9*s.* 6*d.* per ton equals £569 (value given in my former paper). The ultimate result being the same, any charcoal may be used at first. The process is carried out without odour, from the closets to the finished products. Of course the process may be modified; for instance, suppose the char to be used five times, and only dried, the addition to its value would be as follows (I take equal parts, as this charcoal will absorb at least an equal weight of even urine):—

1 ton seaweed char at £2 = 30 cwt. manure at £9 7*s.* 6*d.*
5 tons excreta at £1 9*s.* 6*d.* = £6 5*s.* per ton.

Or, if re-burnt, it would yield 25 cwts. of charcoal, and the whole of the nitrogen would pass over in the distillation as ammonia. Dr. Wallace estimates the cost of re-burning char in sugar refineries at 3*s.* 6*d.* per ton for labour and fuel, containing 31 per cent. moisture, which would be much over that referred to. Here, then, we have a simple process for recovering the whole of the value from excreta, of general application, and the results of which can be predicted by chemists with absolute certainty, as far as those products to which we at present attach value are concerned.

Mr. Stanford goes on to say that the uncertain portion is, as usual, the most interesting, for in it we are exploring a new field, which promises great interest.

I have brought the subject forward here as of great interest, especially in relation to hospitals and foreign stations.

The CHAIRMAN: We shall be happy to hear any remarks that gentlemen may feel inclined to offer on this question. No doubt a large amount of time would be required to solve the difficult question of the disposal of sewage, and the man who does so, will be a benefactor to his race; but I am sure everybody here must feel that this, as a sanitary question, is one of very great and very vast importance. The problem to be solved is, how is this sewage gas, that is supposed to be contaminating our rivers and our houses, to be rendered perfectly innocuous? Charcoal, in some form, is named as the panacea. The question is—how is it to be done? I do not know whether anybody here has devoted any time or attention to the subject; if they have, probably they will be kind enough to favour us with their observations. For my own part, I cannot see any practical solution of it.

Colonel ALCOCK: As you have been kind enough to invite anybody to express an opinion, I should like to be allowed to say that I think the subject of this lecture exceedingly well chosen at the present time, because it is very probable that some sanitary legislation will be required during the present session. There is much importance not only in what scientific men may bring forward, but also in what practical men may have to state; and any discussion which arises will be of the greatest possible advantage, as throwing considerable light upon matters which are probably but little understood. It is quite clear that we are on the threshold of great changes, for science has proved their necessity, while melancholy occurrences in very many families have forced their consideration upon the attention of the public. Still, you have to overcome fixed routine and established habit; you have to overcome prejudice and certain rules—and that is very difficult to effect. Sometime ago, I was at a Poor Law Union, and had the curiosity to ask what were their sanitary arrangements; and the person who was kind enough to show me over the building, told me that as at night, after the doors were shut, the bad air that came through the sewers into the building was perfectly intolerable, it was decided to try some experiments. The first thing they did was to put a stop to this, and the immediate effect was that they had pure air in the hospital. The sewage had passed into the harbour. In order to remedy this, they introduced experimentally three different systems. There may be more, but there are three well-known systems of what is called the dry process. Up to that date they had been polluting the water and rendering the air of the hospital intolerably impure, and at the same time paying £30 a-year for manure, which they now provide from the premises.

I know also another instance, which I happened to see in print. A lecture having been given upon some sanitary subjects, a poor woman who was present, said, "I "have lost eight children; but if I had ever known before what I have heard this "day, I do not think I should have lost one."

A good deal has been said about the Small-pox Hospital at Hampstead; and the

objection that it would bring the disease into the neighbourhood, was looked upon almost as frivolous; but it did do so, and the reason why it did so was that there was a communication through the public sewer between a great number of houses and the hospital, and small-pox broke out in that neighbourhood. I think that instance was very conclusive. I do not, of course, go into these subjects with any pretension to scientific knowledge upon them; but I have ventured to mention these matters that have come under my notice, in the hopes that some other gentleman will be kind enough to follow my example, and that with the chemical and medical knowledge which I do not possess.

Mr. RAWLINSON, C.B.: I received an invitation to come here, I suppose because it was thought that by listening I might learn something useful; but I have learned nothing practical. I do not think I ever heard more fallacies crowded into the same space of time. I wish to speak with all respect of General Synge; I cannot, nevertheless, refrain from cŏming to that conclusion. I will, however, try to show him why his propositions are fallacies. If the public health is to depend on the abolition of sewers and drains, it will be a very remote period before we shall do that. I will refer General Synge to the reports issued by the "RIVERS' POLLUTION COMMISSION," and he will there see that which, if he continues of the same mind, must drive him to utter despair, because if London were treated by his charcoal process in the most perfect manner that he himself could wish or devise, the sewage of London would be rendered very little better than at present. Surely he must have looked at this subject from one side only, and I am quite aware that there are two sides to every question. The story of the shield is very old and very true. I probably may have been looking at it from the opposite side; but, taking the thing generally, what you require for health is to remove swiftly, easily, and cheaply the effete matter of the population, of all kinds, not of one kind alone. Everything that is done with, which has become waste material, must be removed. Many of our towns which have refrained to adopt sewers which the General seems to dread, and which he calls the "water system," have tried the dry system. Many of the Lancashire and Yorkshire towns have endeavoured to apply some such system as General Synge seems to recommend, namely that of having hand movable apparatus—charcoal, the General prefers. In those towns where latrines, privies, and movable boxes are used, there is the highest rate of mortality, the greatest amount of labour, and the greatest possible expense. With regard to the water system, the mortality returns show that where you have a complete system of sewers, drains, and water-closets, you have the lowest rate of mortality. Those facts being put together, should convince you that there is not altogether the evil in using water that we have been told there is, and that there are many advantages which I could detail which are not to be obtained by the dry movable box methods. Take any dry system that has ever been invented, and you necessarily multiply the manipulations in every household in placing and again in removing the apparatus and the material in and out. I would ask any gentleman in this room, if the law were altered, and he were compelled to take the water-closets out of his house, and only to use the sewers and drains for removing slop water, and were to use the best devised earth closet or charcoal closet that could be brought him, how long would his servants stop with him? How many more servants must he have to do that necessary work? And if the cart did not wait upon him with punctuality—and we who live in London, and have dry matter to be removed, know that these men do not wait upon you with punctuality—what sort of difficulty would he be in? Then, as to the danger of contagion from evaporation, I think that the General, who has spoken several times about the laws of nature, if he had studied them a little more closely, would find that impure water being evaporated, does not give off its impurity to the extent he anticipates. What is the great purifier of water on this globe? The ocean. What is the ocean? Salt water. What comes from the evaporation of the ocean water? The purest water we know; the ocean is, in fact, the only source of pure water. Now I, as a Government Commissioner, have had to investigate this question with regard to the Rivers' Pollution, and I am not here for one moment to advocate pollution of any kind—especially river pollution; but when I tell General Synge that that case has been investigated not only in gross, but in detail, that house to house investigation has been made on the margins of the foulest rivers in England—far fouler than the Thames ever was

at its foulest—and that these districts having been thoroughly examined, it has been found that the charge cannot be brought home to them of creating disease in excess. There have been many investigations made in districts in Lancashire and Yorkshire where rivers exist which are positively as black as ink and as stinking as fluids can be, and yet the houses bordering those rivers and in the district, have had a less rate of mortality than houses situated further away, where they happen to be more crowded together, and the cesspool matter is confined behind them. I have, therefore, been compelled to come to this conclusion—that if you pass fresh closet refuse into water that is flowing in not less than ten times its volume of fresh water, you have done with it as an injurious agent. If, however, you stagnate it, either in tanks, in cesspools, or in any places where the sediment remains as a coating upon the surface, you may create disease; but let that polluted water continue in motion, as in a well-constructed sewer, and it goes to any point you like, without causing injury on the way, and you can manipulate the whole at the outlet or outlets. In discussing the sewerage question, do remember that this metropolis is the largest city in the world that is purely and entirely a water-closet city. There are upwards of 700,000 soil-pans and water-closets in this great metropolis, or about one to every 5½ people, all draining into the sewers of London. Those sewers go down and empty themselves into the Thames at Barking and at Crossness, which I say they should not do; but however they do empty into the Thames at those points, and, at this moment, London stands at the head of all the cities of the world in relation to its public health, and yet look at it in its population! Go into its denser parts—go into its old lanes and alleys, where there are houses six and seven storeys high, and the width between them is not much more than the length of my umbrella, every floor being tenanted, crowded from top to bottom, where life has the least possible value, where health has the least possible chance, inhabited by gin-drinkers and foul livers of all kinds, and, notwithstanding, averaging these with the general population, you have a rate of mortality varying from 22 to 25 and 26 per thousand, when in other large towns, even in England, it ranges from 30 to 35 and 40, and, on the continent you get it even higher. I do say, when you are dealing with a sewered and water-closeted city, and you find such results, how can the charge be justly brought against the system that it is destroying life wholesale? and how can you with truth make the charge that the persons who devised it were all insane, and that you ought to turn to something that is absolutely unknown? I have been obliged to investigate these questions both individually and officially, and have gone through asylums and public buildings where they have introduced the dry earth to supersede water-closets. So long as there is a person enthusiastically looking after them, determined to carry out the pet system, he makes it answer; but let him make a debtor and creditor account of the trouble and cost, and let him debit the labour with anything like its value, and you will see that the so-called dry closet cost is 10 to 1 that of the water-closets with sewers and drains. I do not wish to speak with any disrespect of any paper read in this place—it would ill become me—I only wish to put such information before you as I have; and I am very sorry that the paper is not one that I can accept.

Surgeon-General GORDON, M.D., C.B.: I am glad to find that doctors are not alone those who differ. The remarks I shall presume to offer will be confined chiefly to the subject as it bears directly upon soldiers and barracks. It strikes me that we have not yet quite arrived at that state of knowledge when we can bring forward our opinions as definite either one way or another. It seems to me, from the remarks we have listened to, that there are equally strong grounds to be brought forward in support of the one argument as the other, and the only conclusion that we are justified in drawing from that is, that there is much room still for investigation. General Synge, in commencing his remarks, made various allusions to the influence of infection with regard to hospitals and barracks. Every one who is accustomed to go among such buildings knows very well that once infection enters them it becomes too late to apply what are commonly called disinfectants. The combination and arrangements of a barrack or hospital ought to be such as to prevent as far as possible the introduction of such an influence, I may observe, especially in hospitals; and, as General Synge included hospitals in his remarks, I hope I am in

order in alluding to them. There are special kinds of infection, which, introduced once into hospitals, render those hospitals for the time, and for long afterwards, utterly uninhabitable. During the late great war on the Continent several instances of this took place, and not only in hospitals built of stone and lime, but in the more temporary kinds, including huts and tents. It became well known then by very sad experience, that when once pyæmia declared itself among the wounded, the use of disinfectants had not the slightest power in moderating or stopping it. The only thing was to vacate the establishment, and not only that, but instances have occurred in which, after the establishments had been so vacated, they had been submitted to fumigation, to cleansing in every possible method, and at the end of three months, fresh wounded being introduced into them, the pyæmia burst out again as if the places had never been vacated. The purport of my remarks is to vindicate the necessity for so arranging buildings as to prevent, as far as possible, an evil which, when once it has broken out, cannot be removed. The next remark I would make is with reference to charcoal. There are, of course, three kinds of infection to be guarded against. There is an infection that is communicable by water; there is an infection which is communicable by air; and there is an infection which is communicable both by air and by water. In India for many years, under the orders of the Government, the use of charcoal has been authorised in barracks, in hospitals, in latrines and washhouses, and the various other buildings occupied by troops. That is with reference to the infection conveyed by air, and there is every reason to believe from the Reports that the existence of the charcoal in these places has been followed by very good results. I find, however, by experiments that have been performed by some of the Continental medical men, there is very great reason to doubt whether charcoal is capable of destroying infection in water. There are certain kinds of infection which seem to resist its influence, more especially that which gives rise to typhoid fever, dysentery, to cholera, and also, it is believed, to intermittent and more severe kinds of remittent fever. However, that is one of the questions that are as yet, so far as my knowledge goes, undefined; at the same time doubts have been very strongly expressed with regard to it. With regard to the remarks on cholera, it is to be observed that in India, where cholera prevails to a very sad extent, one of the regulations laid down in regard to it is, that all excretions, all liquids coming from the person of the infected, should in the first instance be disinfected by a particular process, partly by permanganate of potash, partly by other disinfectants in common use, and that then they should be specially buried in such a manner as, if possible, to prevent any evil effects arising from them and being communicated to the troops. I may also observe during the siege of Paris the practice was adopted of similarly collecting and destroying, after being disinfected, all the clothing, the dressings, the secretions and excretions, of the wounded in the hospitals. But, again recurring to what I said of pyæmia, so little effect had all these remedies, that in some large ambulances—as, for instance, that of the Grand Hotel—so fearfully offensive and powerful became the odour from pyæmia and from other hospital diseases that were prevailing, that during the time it was occupied towards the latter part of the siege, the odours were perfectly perceptible to those who walked along the Boulevards on the one side, and the street near the New Opera on the other. It illustrates how extremely powerful the infection is when once it becomes introduced, of whatever kind. With reference to the dry earth, it strikes me that dry earth conservancy can only be applied under certain conditions. For example, it requires an immense quantity of earth when employed for a large number of people. That earth has to be got somewhere, and it becomes a very serious question how it is to be disposed of, and there is reason to doubt whether, even when practised with the utmost care, it is really efficient. We know that the practice of the dry earth system is no new discovery. If we refer to the days of Moses, we find it was followed out in his camps. Various experiments on the subject were made in India, and it was found that, however carefully mixed, and however long it might remain, when spread afterwards upon the ground, and when the rains and the elements worked their effect upon it, then it became offensive to the senses. In China also, where it has been practised from time immemorial, the same thing occurs; the fields, as any person who has been in China knows, where this is used, are extremely offensive. Those who have studied the matter believe thoroughly that diseases such as typhoid

fever and dysentery are very liable to be spread by it in both conditions. When it is dry their germs are spread abroad by the winds, and when it is wet, they are spread in a liquid condition.

Colonel MURRAY, Commanding R.E. Officer, Home District: I came here very much like my friend, Mr. Rawlinson, with a view of learning something; because, with regard to the conservancy of barracks, I suppose that if anybody has got a new system of conservancy which is practicable, and can be carried out at any moderate expense, there never was a time in our country which presented a finer opportunity for it than the present. The new localisation scheme involves the erection of a great many new barracks. There are 26 new barracks to be built in England. I have four or five to build, and at hardly one of them is there the slightest facility for drainage of any kind. I am at my wits' end, and can only say I shall be most happy if anybody will give me in detail a scheme which will meet with the approval of the authorities. I came here, I say, with a view of learning something, and I candidly own I have learnt nothing. I have heard general theories propounded that it is very wrong to pollute water. I dare say it is, but how am I to wash without polluting water? How am I to carry on domestic household duties without polluting water? We cannot wash in charcoal. You must show me what I am to do with the water when it is polluted, because I find that is the great difficulty. I have had a good deal of experience in building barracks at Aldershot, and I saw a good deal of the drainage. We polluted the river; it was a very nice little trout stream before we came here, and I had the whole country down on my back. Not that I did it; the drainage of the camp was carried out by a very eminent civil engineer. Lord Panmure had a very bad opinion of military engineers, and he entrusted this work to Mr. Simpson. He did not know what to do with his dirty water. He knew what he could do with the clean water, and he put down two systems of drainage, a clean system and a foul system. He discharged the clean water into the Blackwater, and his foul water drainage into some pits. He trusted to Providence to get rid of it—he hoped it would soak away. It required a 10-horse power steam-engine to pump the water out of this place, where these tanks were made. The result was the place became a large fœtid swamp; you could not go in summer time within a mile of it. In perfect despair I cut a grip, and let it out into the Blackwater. I could not help it. Even before that was done, what had been intended as fresh water drainage was very nearly as stinking as the foul, in fact I do not think you could have told the difference. This was very remarkable, because in these days there was not a single water-closet in the whole camp; there was not a water-closet to any Officer's but a General's hut; the whole system of conservancy was a dry one. We were at that time paying £1,200 a year for carrying away the whole of the contents of the latrines to a man who came and sprinkled them every day with charcoal. They were all received in wrought-iron tanks, which were over the ground; notwithstanding this, nothing could be more offensive than the water which was discharged from the camps at Aldershot. I was there five years, and saw it myself, and I do not believe that the difference of adding the water of the latrines to the sewage has made any appreciable difference in the noxiousness of the effluent water. The only system that I have heard of at all approaching what we want is the sewage irrigation scheme. As far as I can see, you must in a barrack have an outlet for your liquid refuse. It might be all absorbed by charcoal, but I should imagine that the cost would be very great, and that it would be totally impracticable to carry it out. A man takes a bath in a hospital, and pollutes 70 or 80 gallons of water. What is to be done with it? Will charcoal restore it, or enable it to be carried away without polluting the streams of the neighbourhood? That is the question. As far as our present knowledge goes, we must have an outlet for liquid refuse, and the best way of disposing of that liquid refuse is by sewage irrigation. If you adopt a dry system for your latrines you deprive your liquid sewage matter of its most valuable constituent as applied to the land, and you also incur a double expense. Therefore, in any place where you can dispose of your sewage by irrigation on to the land, it is much better to mix it, and let the latrines go with it; it is much less costly, and it also improves the value of the land irrigated. There is another great difficulty with regard to the dry earth system as applied to barracks. I do not at all find fault with the regulations laid down by our

medical Officers, and carried out by the Control Department. We have had a great many barracks, and notably in Ireland, where the dry earth system has been adopted for the latrines. It certainly is a fact that up to the present day the rivers in Ireland have been preserved with much greater purity than any of our rivers in England. Their manufactures certainly are not so extensive, but even with regard to the ordinary sewage of towns, I do not exactly know how they manage it, but during my charge of the barracks I found that we had more complaints from Ireland if we attempted in the slightest degree to pollute the water than we had anywhere else, and they have thus managed to keep their rivers tolerably pure. We have had the dry earth system also in operation at the cavalry barracks at Brighton, and it answers tolerably well. The regulation I refer to, as laid down by the medical Officers, is that the earth shall not be used more than once; it must be immediately removed out of the barrack after once being used. That is a capital regulation, as far as regards health, but a very bad one as far as regards finance, because that earth has little or no value as a manure, it is absolutely worthless; you must use the earth, and you can re-use it six times at least before you can make it of any commercial value as a manure. This is a subject to which I gave a great deal of attention during the five years I was at the War Office, and had charge of all the barracks. There were subjects daily coming before me, and this was one of the most perplexing with which we had to deal. I cannot help thinking that we have made very considerable improvements over the barracks that I can remember thirty years ago. It is a subject which is not only found to be of very great difficulty in England, but also abroad. I remember several distinguished German princes coming to Aldershot, and there was scarcely anything in the barracks that they cared to see but the latrines. It was—"Show me your latrines. How do you get over this difficulty?" from which I gather that others are still coming to us for instruction, and we are not behindhand, as far as the age is concerned, generally speaking, in our conservancy in barracks. I for one shall be very thankful if any one can give, not these general theories, but a plan in detail which may be applied in practice, showing how sewers can be abolished and how we can get on without them at a moderate expense. If such a plan, and one which the authorities will accept, can be produced, I shall be delighted to give every assistance in my power to facilitate its adoption.

Mr. RAWLINSON: There are two systems in operation at Aldershot; you have the "Goux" system and the irrigation system. As far as the authorities are concerned, they have been satisfied with the Goux system; but the proprietor told me himself that he had entered into an arrangement with the War Office that he could not abide by; that is to say, he undertook to remove the material without it costing the Department anything, but he had been losing money by it.*

General SYNGE: At one time, I was almost afraid that the purpose and hope of a discussion would fail, and I felt, like my countryman, I wanted very much indeed to have some one tread on the tail of my coat, when Mr. Rawlinson was kind enough to do it, in what he conceives a very effectual manner indeed. I think the remarks sum themselves up very much into this—that I have only generalised, and not particularised; and that I have advanced a tissue of fallacies, to put it mildly, in almost every statement I have made. I did not intend to speak upon the sewage question. I purposely avoided every expression of the sort; and I did not intend to bring up the general question, not deeming this the place in which it should be discussed. It put me in mind that a good many years ago, when I was a very young man, and had the honour to lecture at the Geographical Society upon a pet subject of my own, about the opening of the Atlantic and Pacific Railway, it was immediately met with, "Oh, you are attacking the Hudson's Bay Company!" And so it was impossible to open up this subject, without bringing up the everlasting irrigation scheme. I shall not reply to that question at all; it is a totally distinct subject from the one I have the pleasure of bringing before you. I have

* General Synge said that fire would alone destroy the germs of disease; but an ordinary fire will not do this. Experiments have shown that a considerable percentage of gases passed into and through a furnace fire, escaped unconsumed up the chimney and into the open air. The powder in a gun-chamber is never all exploded, so that fire must be relied upon with some reservations.

endeavoured purposely and carefully to abstain from seeming to be the advocate of any particular mode of dealing with any particular thing. I do not admire making scientific Associations the advertising mediums of commercial adventure. There are places and times in which it is quite appropriate to go into these details. Therefore, I endeavoured to ground my work first of all on what I considered an immovable basis—that law of creation which Mr. Rawlinson good-humouredly twitted me for referring to.

The first broad statement I make, then, which he would call a fallacy, is, that the agency of fire destroys the germs of infection. You are capable of judging for yourselves whether that is a fact or a fallacy. The next statement I make is, that water spreads those germs of disease. You are capable of judging for yourselves whether that is a fact or a fallacy. I go a step further, and I say that the most ingenious contrivance for spreading germs of disease is found in making water the vehicle by which you distribute them. I go a step further, and I say that the most pernicious application of that dissemination that you can hit upon is letting the emanations into your houses. I go one step further, and I say that the most mischievous application of that admission that you can make is to let them in in diluted quantity into your bed-rooms, and I am perfectly convinced, by the evidence obtainable to us all, that there is a good deal of matter for grave reflection in the fact that Dr. Gordon brought so well before us that the very grossest accumulations of dangerous matter left an unappreciable amount of direct injury, and that you could not trace the effects of this matter to any particular cause. That, however, is going into medical ground that I am not competent to speak upon, and I should then have to argue Homœopathy *versus* Allopathy. I had a dog of my own poisoned, and and he ate so much of the poison, and so greedily, that he was not any the worse for it. My little pet dog was poisoned at the same time, and, being a very dainty feeder, died of it. I can just as well reason from that that there was no deleterious substances in the poison. There are distinct occurrences from which it does not do to generalise, but there are other principles that never vary, on which you may safely build, and I have endeavoured to distinguish between those two. Following the statements I have advanced, I shall content myself by leaving the decision in your hands, not to be given in my favour, or against me, but for you to form your own judgments as to whether it is true that fire is an instrument that is destructive of the germs of disease, and that water is a disseminator of them. I do not know whether you would wait to reflect much upon whether heat or cold are the most desirable things to surround yourselves with in this climate, but that was another thing. I ventured to say that it was more desirable to have our dwellings underlaid, with means of warming them, than with the means of wetting them, and letting in bad smells.

Mr. Rawlinson said, if you could only go on fouling water for ever, it would flow on, finding its own legs and arms and wings, and so on, and would never injure you. Unfortunately, there is a limit to the globe, and I do not know how water is to go on for ever, nor am I aware how water on a low level is to flow on to a higher one without artificial aid. I avoid entering in detail into all these things. I do not know that the chief point that I advanced before you has been at all touched—the propriety of dealing with infected matter in hospitals by the agency of fire. And I also say that there is a vehicle, not resting on my testimony, resting on actual experience, resting on the testimony of medical officers in official situations, that it is a perfect carrier—I started with that. The gentlemen who have been kind enough to come here and have learned nothing, were no doubt aware of these facts before; but they have not particularly called your attention to the circumstance that there is the strongest possible testimony of medical men in the city of Glasgow that it is there found to be an efficacious arrangement. That was not an arrangement—I happen to know the particulars—sought by any particular agency; it was sought by the town itself, and was pressed upon an agency working there, and the separation that Dr. Gordon has pointed out should be universal in all military hospitals between infectious and other cases, is there an actual fact. It is in the Small Pox Hospital that this charcoal application is made; it is also in the Convalescent Hospital; and seeing it with my own eyes, being thoroughly convinced of its perfect efficacy and extreme cleanliness and suitability, I was struck with this, and wished

it to be extended to other hospitals, and in fact it is from that visit I may probably date whatever I have had the opportunity of bringing before you now.

Colonel Murray dwelt strongly upon the impossibility of not polluting water. Water was given first for drinking and next for washing, and you cannot wash, as he justly said, without polluting. But he did not sufficiently dwell upon the distinction between CORRUPTION and POLLUTION. The *corruption* of water I hold to be unpardonable, and its *pollution* inevitable; by the corruption of water I mean putting into it matter that makes the water itself putrescent—putting it in unnecessarily. There are accidents that might happen. For instance, that you can corrupt water by other agencies than the particular one that has been so largely brought forward, I suppose is a thing no one would attempt to deny; but that you should increase your difficulties wantonly is quite another thing, and that you cannot deal with them in detail is an unproven thing. I do not think I should be justified in saying it is a proved thing that you can, but I can prove, if I may trespass not much more than two or three minutes more upon your time, that there is not the difficulty in the matter that may be supposed. We are dealing with hospitals, barracks, and so on; the incidents to them are pretty much the same as in ordinary life. The solid outcome from the human body can be dealt with very satisfactorily as far as that is concerned. The liquid portion of that outcome can also be treated by separation in a manner that is feasible and not very complicated. I need not dwell upon the details of doing that, because it is incidental to the charcoal treatment. I do not dwell upon the objections made to dry earth, because I did not at all speak about it; it is a thing I condemn myself under all except some very exceptional circumstances. I believe it to be the best thing for movable camps, but to bring it forward as a thing that would act from the basis on which I have placed it, that of destroying disease, I hold to be utterly untenable.

You next come to kitchen waters, which are very offensive, but you can strain them through a medium until it deprives them of offence and leaves them to go off in a pure form. I believe a great many persons who think water carriage is necessary, imagine we want to turn all the water into charcoal, and, as Colonel Murray says, want to wash in it. It is not that; it is to deliver the water in an innocuous condition, and this can be obtained by filtration, either mechanical or other, and the water passes off harmless and pure. That would be a matter which others may deny, but as it is capable of demonstration, I shall not reason about it—you can set it up and see whether it can or cannot. But I do not think there is anything necessarily in the character of a fallacy in saying that if you separate the ingredients of house or barrack life in this way, that you find the difficulty disappears. So eminent an authority as Sir John Hawksley has expressed what is tantamount to the same opinion. He has stated broadly the converse of it—that what you can do in detail you cannot do in bulk. You cannot apply to a population of 5,000,000 what may do for 1,000. Kitchen water is most offensive and troublesome, but by intermittent filtration it can be purified. It is a thing that can be tried. It requires two tanks only, put side by side in the kitchen; cover them with a tray of charcoal, pour your contents through this charcoal, let it go through the first receiver, and then, by an intermittent syphon action, let it run off. I know it has been done for a year under my own cognizance, and that it answers perfectly. Washing-water and scrubbing-water is a mere question of mechanical filtration, and therefore the difficulty disappears there also.

I have the satisfaction of not pleading for anything that I have found out myself. I cannot, therefore, be misled by self-love; it is only that the weight of evidence to my mind inclines in this direction. I am, therefore, glad to have had the opportunity of bringing it forward here, and hope that as much weight as may be deserved may be attached to the difficulties that have been pointed out to be in the way of the adoption of this system, and also to those facts which Mr. Rawlinson has pointed out as fallacies, of which I leave you to judge whether they are facts or fallacies.

The CHAIRMAN: I am sure you will all return your thanks to General Synge for his lecture, although he may not have shown that there is a great deal in the subject. We certainly owe him our thanks for the trouble he has taken in coming here.

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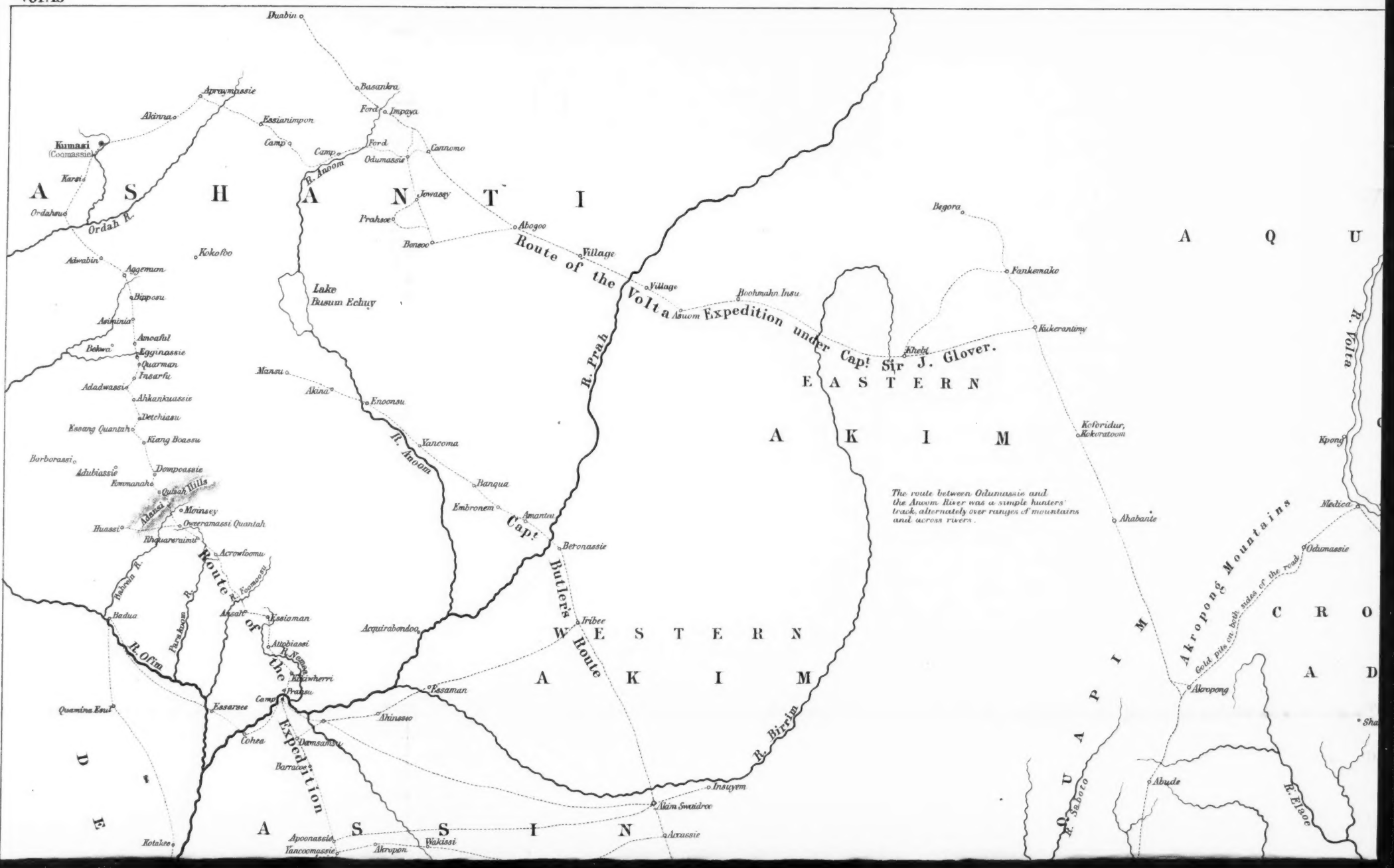

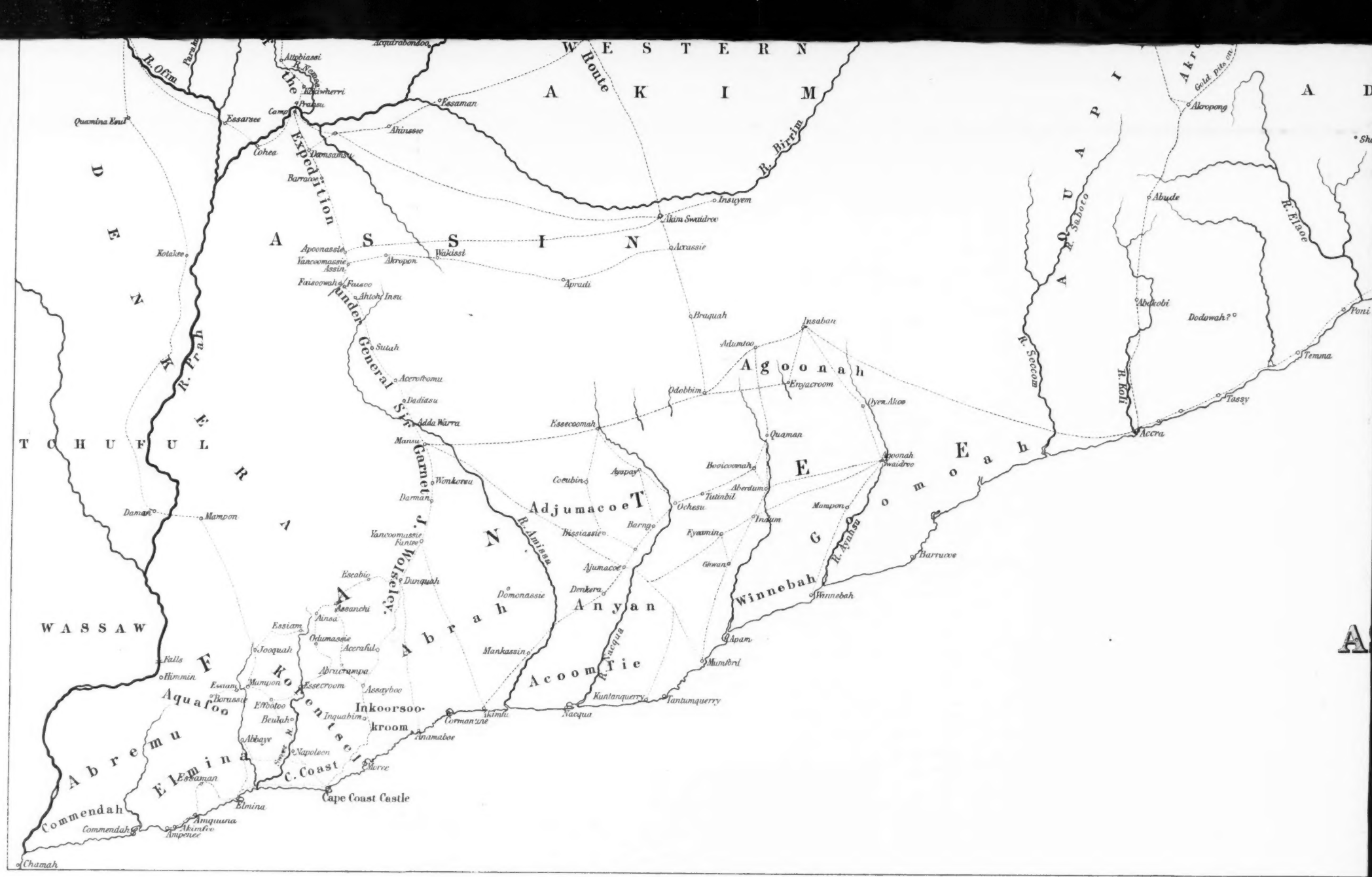
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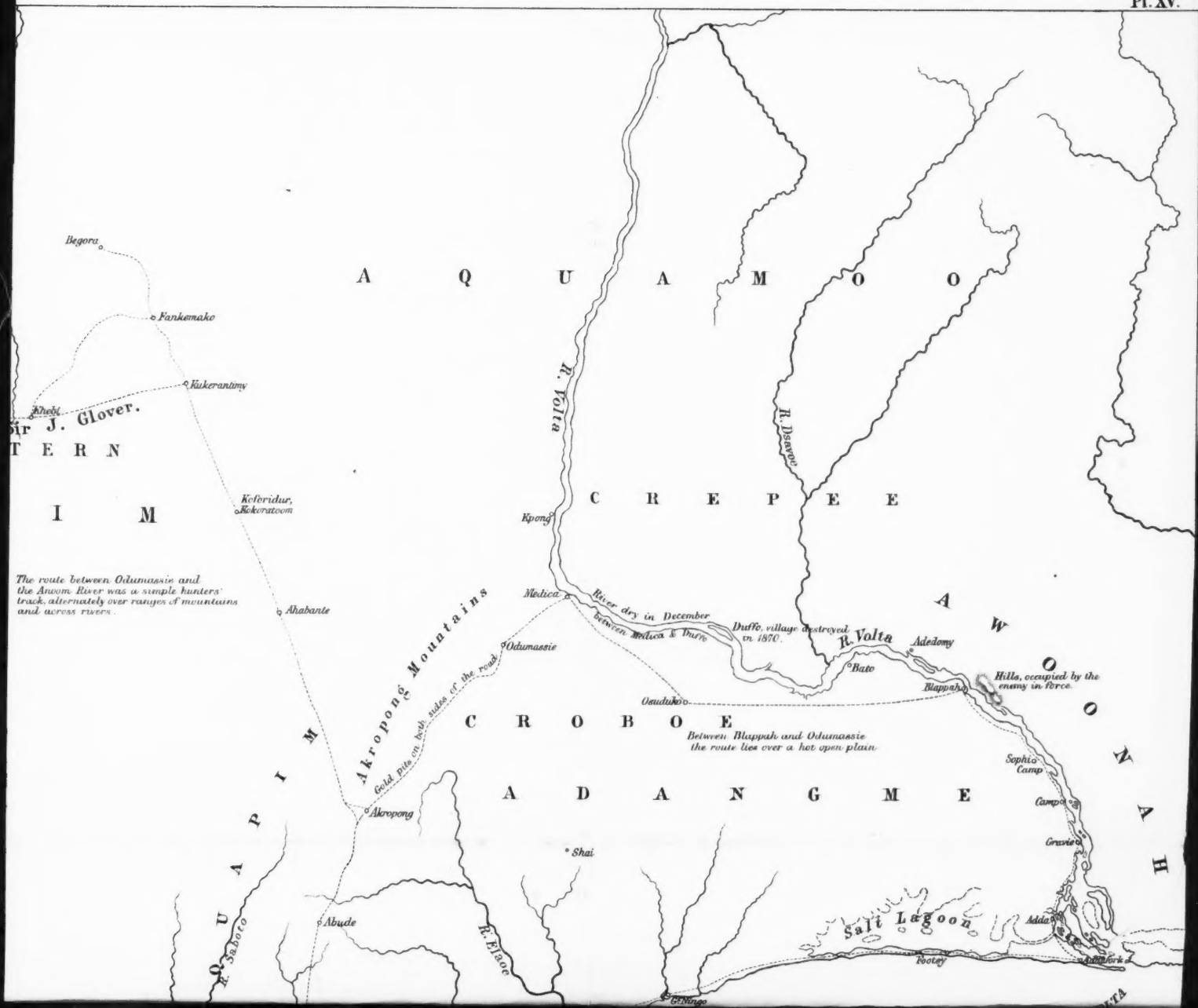
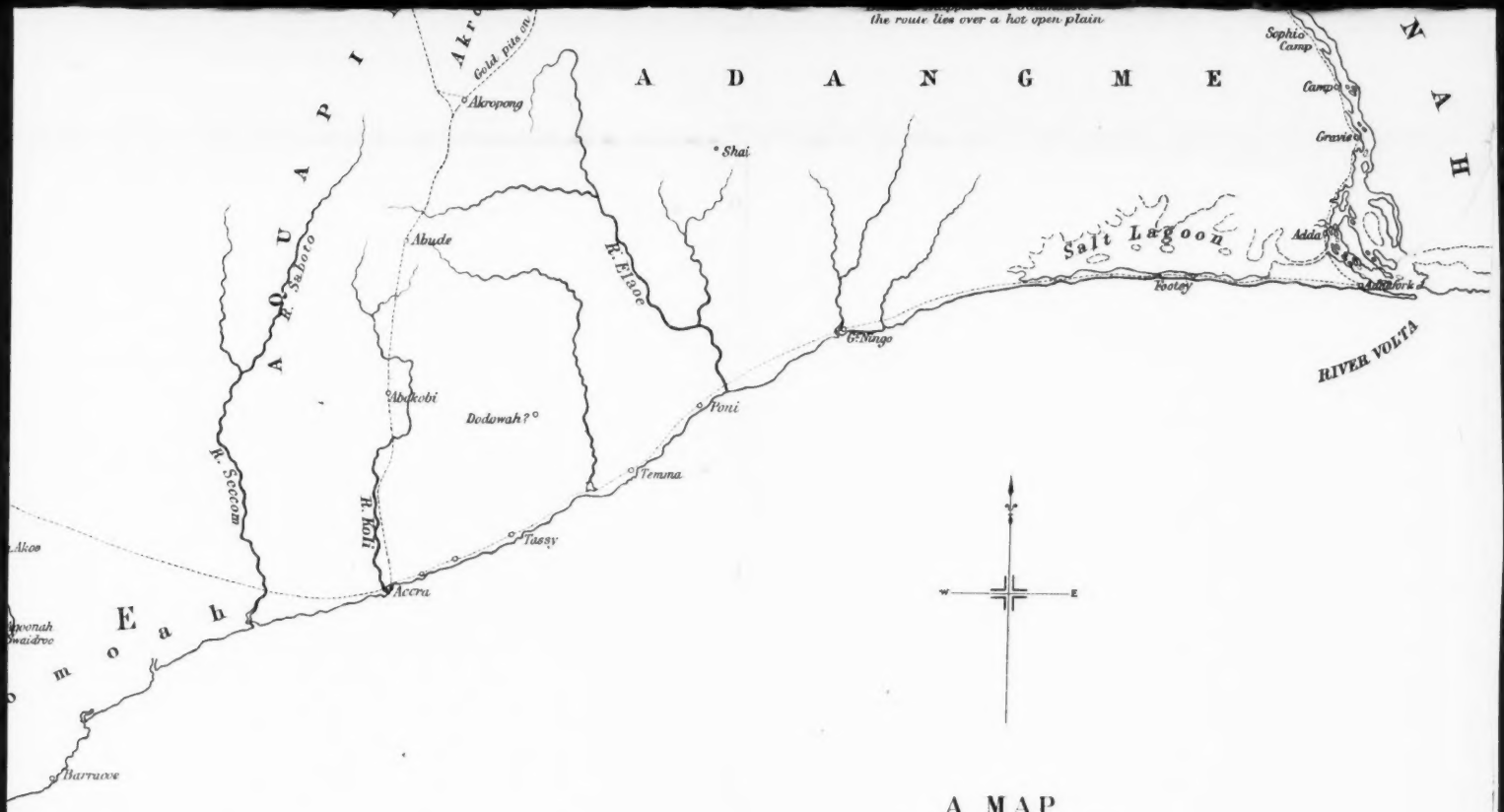
Indum
Mampon
Barrucoe
Winnebah
Apam
Mumford
Kuntanquerry
Tantumquerry
Nacqua
Ikimfu
Corman'ine
Anamaboe
Mankassin
Domonassie
Denkera
Ajumacoe
Barnip
Fyaumin
Ginwan
Bissiassie
Coobin
Ayapay
Wankoreu
Darman
Manso
Adda Warra
Sutah
Accrofromu
Dadiasu
Ahtiohy Insu
Fausco
Fuisoowah
Apoonassie
Vancoomassie
Assin
Akropon
Wakissi
Akim Swaidroo
Insuyem
Acrassie
Apradu
Kotakee
Quamina Essu
Essarree
Camp
Prahsu
Akawherri
Attobiassi
Acquirabondoo
Essaman
Ahinsseo
Damsanso
Cohea
Barracoe
Dunquah
Escabie
Assanchi
Ainsa
Essiam
Odumassie
Accrafull
Jooquah
Abrucrampa
Essecroom
Assayboo
Mampon
Borassie
Effootoo
Beulah
Inquabim
Abbaye
Napoleon
Sweet
Mouree
Essaman
Elmina
Amquuna
Akimfoo
Ampenee
Commendah
Chamah
Himmin
Falls
Daman
Mampon
Vancoomassie
Fanteo
Essiam
Gold Pits on
Shai


Begora
Fankemako
Kukerantimy
Kheld
Sir J. Glover.
TERN
IM
Keforidur,
Kokeratoom
The route between Odumassie and the Anoom River was a simple hunters' track, alternately over ranges of mountains and across rivers.
Ahabante
AQUAMOOO
R. Volta
R. Dsavoe
CREPEE
Kpong
Medica
River dry in December between Medica & Duffo
Duffo, village destroyed in 1870.
R. Volta
Adedomy
Bato
AWOONAH
Hills, occupied by the enemy in force.
Blappahoo
Osudukoo
Odumassie
Akropong Mountains
Gold pits on both sides of the road
CROBOE
Between Blappah and Odumassie the route lies over a hot open plain
Sophia Camp
Camp
Gravie
Akropong
ADANGME
Shai
QUAPIM
R. Saboro
Abude
R. Elaase
Salt Lagoon
Adda
Footey
Ningo



A MAP
TO ILLUSTRATE THE
ASHANTI CAMPAIGN
1873-4.

English Statute Miles.

5 4 3 2 1 0 5 10 15

Stanford's Geogl. Estabt. Charing Cross.

LECTURE.

Friday, May 15, 1874.

VICE-ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B., Chairman of the Council, in the Chair.

THE VOLTA EXPEDITION, DURING THE LATE ASHANTEE CAMPAIGN.

By Captain Sir JOHN H. GLOVER, G.C.M.G., R.N.

I BELIEVE that I have the honour of standing before you to-day in consequence of so little having been known of the expedition which I had the honour to command during the late Ashantee campaign, and for this reason, that we had no reporters of the press with us. One daily paper having dubbed us all "filibusters," and having said on our return that we should be tried for our lives twenty times over, satisfied themselves with that, and left us. That, I very much regret, because I am sure that the public, and we ourselves, lost much by not having an account of our proceedings duly reported.

On the 3rd of August last, having been honoured with the confidence of Her Majesty's Government, I was told to go out and organise an expedition of 10,000 men; and the confidence which Her Majesty's Government placed in me was fully evidenced by what I shall tell you. Lord Kimberley was good enough to let me name my own salary, and I was not only allowed to choose my own staff, but every detail of the expedition was left to me; in fact, the fullest confidence was placed in me. On the 19th of August, I left England, and having arrived in due course at Accra, we encountered our first difficulty. That difficulty arose from the opposition of the native kings on the seaboard, and from the system of slavery which, I am sorry to say, exists there. A great deal of time was apparently lost before any movement was made; consequently, I regret to say, no very great result was anticipated from the expedition; but I think when I have put before you what took place between the time when we landed at Accra, namely, the 12th of September and our crossing the Volta on Christmas Day, the public will see that our time was fully occupied, and that we did not allow the grass to grow

under our feet. On my way out, of course, I laid before the members of my staff the operations that were likely to take place; and having pointed out to them that the enemy were then occupying a position before Cape Coast Castle, our first duty was to create a diversion in the rear of the enemy, and thereby loosen the grip which they were holding on the seaboard near that place. I had with me a very distinguished officer, Captain Sartorius of the 6th Bengal Cavalry, and showing him where the enemy was, and where the first operations were likely to take place, I offered him the north-west frontier and the organisation of the two Akim tribes. I need not say that Captain Sartorius accepted that service, and immediately on our landing, he proceeded to make preparations for organising those forces.

On arriving at Accra, the first point was to assemble all the Kings and Chiefs of the Eastern Protectorate; and I thought it would save time if, instead of calling them all to Accra to have a week's carouse, we should ourselves go half-way to meet them; we therefore went up to Akropong, and summoned them to assemble there. That, of course, was readily obeyed, with the exception of the two Kings of the Akim tribes, who, in consequence of the heavy state of the roads which prevented travelling, did not appear. Some time therefore, was lost; and somewhat later we collected these chiefs at Accra. There a great deal of swearing took place, and a great deal of enthusiasm was manifested. They swore by Sir Charles Macarthy's old blue coat, which is their great oath, and threatened to forfeit their heads if they did not obey the orders given them, and expressed the utmost regard for the Queen and the British Government. But swearing the great oath seems to be with them the beginning, and very nearly the ending of their duties; they consider that having sworn the oath, that is sufficient.

I told you that our difficulties arose from the system of slavery. I was ordered to raise and organize a force of 10,000 men, 1,000 of whom should be Houssas. I am sorry to say we were only successful in adding 250 men of the Houssa tribe to the force already collected, in consequence of what I am about to tell you. As soon as it was known that the Houssa force was to be increased, all the kings and chiefs on the eastern seaboard, proceeded to put their Houssa slaves into irons, and it was (with few exceptions) only those men who broke their chains and came to us, that were enlisted. The Houssa men who had been with me at Lagos for many years, and who were in the habit of considering, that, when a slave put his foot on British territory, he was free, could not discriminate between the difference of position of a slave in a protected territory, and that of one coming on *bonâ fide* British soil, and, therefore, when they found the King of Accra was putting his own Houssa men into prison to prevent them enlisting in the Queen's service, they broke down the king's prison. On the people of Accra disapproving of that proceeding, we got into difficulties, the Houssa men chopping open the chiefs' heads and flogging the townspeople, and giving me a great deal of anxiety, because I was quite certain, that if, immediately on landing, we came into contact with the natives, it would be said that our endeavours to

raise a force would be a failure, and the people of England would have some anxiety as to the result. However, by putting plaister on the chiefs' heads and paying very great attention to their ladies,—which is a point I never overlook in those countries,—we succeeded in getting our force down to the Volta. The difficulty was,—and it was a very great one,—that when I once left Accra, the people there would not rise. I, therefore, left behind me a puncheon of rum, which was to be given to the ladies when they had flogged the men out of the town. That is their mode of getting the men to war and of raising their native army. It may be said, when it was known we were to march a force to Coomassie, that naturally a depôt would have been established on our line of march. This was not overlooked, and stores, provisions, and ammunition were landed at Accra, to be taken up to Khebi in Eastern Akim. The King of Eastern Akim was a young man, and eventually proved himself a very brave one, but, instead of devoting the money which I gave him to paying his people to carry up our loads of ammunition and stores, he invested it in salt, and therefore, as his people had to carry the King's salt up, they could not carry our provisions, consequently, all those provisions and stores had to be re-shipped from Accra, taken down to the Volta, and carried up that river to Duffo, and eventually brought overland at the last moment up to the Prah. As soon as Captain Sartorius had got up to Khebi, I received orders from Sir Garnet Wolseley, to say that he intended to cross a force from Western Akim, and that no communication should be entered into, between myself and the King of Western Akim, in order that the King should join the force before Cape Coast Castle. I am quite certain, had Sir Garnet Wolseley known the result of this order, he would not have detached the King of Western Akim from the force I was about to raise. No doubt he was advised by people in Cape Coast Castle, who were most anxious that the great fighting Chief of the Eastern Protectorate should join *them*, and be detached from *me*. I am quite certain, that had Captain Sartorius been allowed to organize the Western Akims with the Eastern, Sir Garnet would have had a most able force commanded by Captain Sartorius and one or two other Officers, and this combined force of Eastern and Western Akims, would have done much better service than did the Western Akims alone, who eventually deserted their Officers and were of no use at all.

We will now go to the Volta. It may be supposed that a great deal of time was lost there; but when I put before you all that we had to do in the way of discharging transports, drilling our men, and organizing a transport corps, you will see that our time was fully occupied; and I must here thank the representative of the *Standard*, and also of the *New York Herald*, who visited us, and who, to some extent, enlightened the public as to what we were doing. I should tell you, that our men had always three parades a day for drill, and each man fired forty rounds of ammunition at a target before we started, and on the last day I was encamped at Adda, the remainder of the force left there were employed in carrying coals from the landing place on the beach to the landing place on the river, which is just a mile, until half-past

ten. They were then allowed a few moments to put on their accoutrements, and we went up to the camp at Sophi. In the meantime Captain Sartorius had succeeded in assembling at Blappah 3,800 men, for the purpose of chastising the Awoonahs, a turbulent people on the left bank of the Volta; and so ashamed was I of the delay, that on two or three occasions I paid this force a visit, and gave them large presents to keep them quiet. I said how sorry I was that, in consequence of the beach tribes not having assembled, I was obliged to detain them. I wrote to the General, reporting the high state of preparation the force under Captain Sartorius was in, and describing their spirit and enthusiasm. I think it was about the 17th of December that I paid them my last visit, and finding that there was no chance of the beach tribes assembling in time, I ordered 1,000 men from Blappah to march by land to Sophi, where I had only collected some 500 men of the beach tribes out of 14,000. I was very much surprised when they told me that they had not the least intention of going six miles down, that they intended to cross there, and to cross nowhere else, and that they did not intend even to cross there for five days. I then felt I could not deceive the General, and immediately wrote and told Sir Garnet that he must not depend upon my crossing the Prah with any men besides those of my discipline force, under 1,000 men. On leaving the camp at Adda, I received the utmost assistance from Dr. Rowe, and without that able assistance we never could have crossed the Prah as we finally did. By his indefatigable exertions, he succeeded in bringing up to Sophi in three days some 10,000 men. On the 22nd of December we commenced to cross the force at Sophi, and, although it was intended to cross at daylight in the morning, in consequence of the hesitation on the part of our native allies, we got no men embarked until half-past ten. The enemy, the Awoonah, were in force on the opposite side, and having embarked some 300 men in steam launches and canoes, I sent them up the river to a point where the enemy were in position, evidently anticipating that we should land at that point. Having, then, got 250 men on a small steamer, which I had with me, I joined the flotilla, and, steaming down the river two miles, threw 500 men on shore at a point where we were not expected. The result was, we met with no opposition, and achieved a firm footing without suffering any loss. Two days were occupied there in crossing 9,000 men. I then rejoined Captain Sartorius at Blappah. You will see on the plan some hills marked: those hills were occupied by the enemy in force, and we saw their camps on the summit. The force which had crossed at Sophi was under the command of Mr. Goldsworthy. He was ordered to join me on the morning of Christmas Day, and to be at the base of these hills at six o'clock in the morning, but, in consequence of the disinclination of the natives to move, he did not join me till six o'clock in the evening. On the morning of Christmas Day a steam launch was sent down to shell the camps on the hills, supposing that Mr. Goldsworthy and his force of 9,000 men would be at their foot. However, not hearing anything of Mr. Goldsworthy by ten o'clock, we commenced to cross the Volta. I wish here to state that Captain Sartorius and myself had a difference in opinion, and being the only difference

which ever existed between us during the campaign, I should just like to mention it. Captain Sartorius wished to cross with only fifty men; but, having had the experience of the two previous days, and finding I could throw 500 men across at a time, I told Captain Sartorius I really could not do him the favour which he wished, and I gave him 500 men instead of 50; that is the only difference of opinion we ever had. Captain Sartorius having got over with 500 men, the enemy's force, amounting to 2,000 did not long remain there; and, having driven the enemy from their position, we had a very comfortable Christmas dinner in their camp.

The next day I found both men and Officers too much done up to move. My intention was immediately to attack the enemy, some nine miles in our front, and (the probable successes of two or three days having put spirit and confidence into our force, which now amounted to 17,000 men) to have left Mr. Goldsworthy with some 8,000 or 9,000 men, and with the rest, to have marched to join Sir Garnet Wolseley in the Ashantee country. But the following day, namely the 27th, I received orders from Sir Garnet to sacrifice everything to the one object, namely to cross the Prah on the 15th of January, with the disciplined portion of my force. It was left to me that if I considered it better for the service, I might remain with the native force, but, under the circumstances, I declined to do that, and left the native force with Mr. Goldsworthy. I am sorry to state that the state of Mr. Goldsworthy's health has prevented him being present here to-day, and also putting in form a paper which, when he is able to do so, will be most interesting to the public, and will do justice to the gallantry which he displayed and the difficulties which he overcame, and which I am sure the public and the Government will appreciate, when the results of those exertions in the campaign are known. Mr. Goldsworthy fought two general actions in the open country with a large force of men. His loss of killed amounted to 50, and, I think, something under 200 wounded. He himself was dangerously wounded; and it was only when he had come to Cape Coast Castle to get medical assistance, having had no combatant Officers at all with him at that time, that the whole of this large force melted away and went home.

On the 27th of December, the Volta was re-crossed with the disciplined force which I had; but we laboured under this disadvantage, namely, that our artillery was left behind with the force on the other bank of the Volta, in consequence of all our transport arrangements remaining with the native force. The native allies refused to proceed with me to Ashantee until they had subdued the enemy on the eastern bank of the Volta. It was the intention, when I left England, that this part of the campaign should be first accomplished, because I was ordered to raise the tribes to the north-east of Coomassie, and it was impossible to reach their country until the tribes on the eastern lower bank of the Volta had been subdued, and our rear and right flank made secure. Therefore I impute no blame to the native force, that they declined to proceed with me to Ashantee, leaving their country open to invasion, and their wives and children exposed to all its perils.

Our march commenced from Blappah, and, as far as Odumassie, it was over a very hot open plain. At this time the river had fallen so low, that our stores, ammunition, and provisions, could be got up no further than Duffo, and the river between Duffo and Medica (the point we reached) was so entirely dry, that the canoes in some places had to be dragged over the bed of the river. Medica may, therefore, be considered as the starting point of our land transport. At the foot of the Akropong Mountains our ascent commenced, and until we reached the Anoom River, our whole line of march was over continuous ranges of mountains and rivers; our road, a simple hunter's track, or the watercourses of streams, which the tropical rains very soon swell into torrents, which wash away all the soil and leave large boulders bare; in fact, our road over these mountains was a simple watercourse. At Odumassie our next trouble was transport. Every man wished to go to war and carry his gun, and to that no objection was raised; but he could not be persuaded without the greatest difficulty to carry a load. After all, we had to fall back upon the women, who are found to be our best friends in those countries. They provided our carriers. But no feeling of patriotism, nor a wish to assist us against the enemy, could induce them to lift a single load off the road until it was paid for; and, with long convoys of carriers, unless watched, they were very apt to throw their loads off their heads, right and left, and bolt. The consequence was, that instead of having a large depôt at Khebi, we had to bring all our stores, provisions, and ammunition, over these several ranges of mountains before we could attempt to cross the Prah. The difficulty was not in bringing up a certain number of men to the Prah on the 15th of January, but to get the force up without being footsore, and fit for work; and I am happy to say, by the discretion and good judgment of the Officers in command of detachments—for we could not march the whole force up in one body—we crossed the Prah on the 15th of January with 740 men, all in sound condition and ready for work. About seven miles from Akropong we came to the gold pits, and one of our great difficulties along the road was to prevent our horses and men going down these pits. On one occasion I jumped my mare over a very large tree, and how she escaped going down a hole I do not know, for she landed with her fore foot close to it. I pulled her up, and put her a little to the right, and there was another gold pit on the other side, and we very nearly went down *that*. I may say that from Odumassie to Akropong the whole country is marked as gold-producing by these pits on both sides of the road.

The more interesting part of our march was, I think, when we were approaching the River Prah. There I had with me only two officers, Captain Sartorius and Lieutenant Barnard, having had to leave the rest behind in a long string or tail at all the different places, to pay and hire carriers, to induce carriers, to coerce them, and to get our stores along. We sacrificed *everything* to the *one* thing—*ammunition;* our clothes, provisions, and everything were thrown aside: the thing was to get up the ammunition. In spite of all our exertions, we had no guns and no rockets when we crossed the Prah. We crossed that river with 100 rounds in the men's pouches, and

four spare rounds of ammunition per man. Captain Sartorius and Lieutenant Barnard, who were in command of the advanced guard crossed the Prah at half-past ten on the 15th; and it was with great satisfaction that by twelve o'clock on the same day I was enabled myself to be on the other side with a force of 740 men. Our astonishment was very great that we had been allowed to cross the river without opposition; however, we found ourselves there without loss. Having secured the two roads in our front, we slept there very contentedly that night, and next morning started for what we supposed to be a town 16 miles in our front. None of our friendly allies, who at Khebi had been ready and desirous to meet the enemy, had come up, and when I started on Sunday, the King told me it was impossible to lift the royal war-stool on Sunday, and therefore he must remain till Monday. I knew very well if he remained till Monday I should not see him, and, as it turned out, he did not join me until, some four or five days after, we had secured a firm footing in the Ashantee territory.

Starting from the Prah on the morning of the 16th, the advanced guard fell in with a piquet of the enemy, at a village half way between the Prah and Abogoo, and there we captured one man, and all their guns. There was something very curious about this man. He was to have been made the next day chief of Abogoo. The old chief of Abogoo and all his men had gone to the campaign before Elmina, and only some half dozen out of 400 or 500 men ever returned. The King of Ashantee thought it might be well to instal a new chief, and therefore sent down a large force from Coomassie to instal the very man we captured at the spy village, and to sacrifice forty slaves on the occasion. The forty slaves were ordered to bring in provisions from the farms to feed the King of Ashantee's people, and they of course gave us this information afterwards. This man was made prisoner, and put under charge of Captain Sartorius's dog "Bell," for we thought she would be able to take good care of him.

Lieutenant Barnard, in advance, had the guide next to him wounded, and at half-past three, after some quarter of an hour's firing, the town of Abogoo was carried by a rush of the Houssa men under command of Captain Sartorius and Lieutenant Barnard. We only suffered a loss of eight wounded, three mortally, who died a day or two afterwards. We found at Abogoo, 200 sheep and all the vegetables which had been brought in from the farms by the forty slaves, who were to have been executed, so we spoiled that afternoon's diversion for the Ashantees. We took also some Ashantee prisoners. The slaves could give us no information of the country before us. They had been brought down some years before from the interior, put on a farm to work, some three or four miles from Abogoo, and beyond the road from their farm to Abogoo, they could tell us nothing. The few Ashantees we took, declined to give us any information, and I think it does great credit to the organisation or system of the Government of the King of Ashantee and his chiefs, that they certainly have instilled into their people a wonderful degree of patriotism: they would tell us nothing. At Abogoo we had to remain

until our ammunition came up, and some of the carriers; for, as I said, we had crossed the Prah with only four spare rounds of ammunition. The time, however, was not lost. The villages on our right and left flanks were visited and destroyed. Three or four days after we were at Abogoo, our friendly allies came in, and begged that they might be allowed to take Bonsoo. I let them go with 300 or 400 men, and Bonsoo they certainly took with a loss, I think, of two killed, and some three or four wounded; but the sight of their own blood so frightened them that they never wished to take any other place.

On the 22nd January (having crossed the Prah on the 15th), and having had to wait for ammunition and our friendly allies, Lieutenant Barnard and a force of 200 men (supplemented afterwards by 300 native allies) were sent to Prahsu. Prahsu, he took, without any loss. I then sent him 200 men, which made up his force to 700. I beg your attention to this particularly, because it was very important for us, and saved us from loss. Indeed, I think, had not Lieutenant Barnard succeeded on that line of road, we should not have reached Connomo, and we should not have been able to have assisted Sir Garnet Wolseley as we did, by having a force on his right flank so far up as Connomo. Bonsoo and Prahsu having been taken, and eventually Jowassy, it was arranged on the 26th, between Lieutenant Barnard and myself, that he should take Odumassie at half-past one, and that I, with the main force, should move up to take Connomo at the same time. About five miles from Connomo, my force fell in with the deserted camps of the Ashantee army, and had their troops only remained on that road, I doubt very much whether the small fighting force we had—some 450 men—(because I had to leave 200 behind at Abogoo), would ever have reached Connomo. But Lieutenant Barnard succeeded in reaching Odumassie, not at half-past one, but at half-past three, carrying it by a rush, as we had carried Abogoo some days before, the whole of the native force remaining behind, and coming into the town some quarter of an hour after he had occupied it. You will see that Odumassie commands both roads—the road in the rear from Connomo to Duabin, and also it cuts off the road to Coomassie. Therefore, the Ashantee force occupying Connomo and some four or five miles in its front hearing Lieutenant Barnard's firing on their right rear, thought it was time to be off, and I am happy to say, for my force and myself, they left the road clear for us. We did not reach within a mile of Connomo until late in the evening; and here I wish to give all credit to the King of Eastern Akim, who was with me, and who crept in and found Connomo deserted. It was then occupied, and the next day I joined Lieutenant Barnard at Odumassie.

I may now give you an instance of the dependence to be placed on our native allies. We must have had in Connomo 1,400 or 1,500 men, but in the morning before joining Lieutenant Barnard we were not sure of our position, because we did not know that he had taken Odumassie, and he did not know that I was in Connomo. Some 400 yards in front of Connomo was a river, and there might have been 400 or 500 Akims washing and bathing. Suddenly an alarm was raised, and the

whole of our native allies brought out their loads and prepared to go. I endeavoured to find out the reason of this alarm; at last the young King said to me, "We see Ashantee." "Well," I said, "that is what "we all came to see." "Oh, but me see Ashantee;" and immediately all their loads were put on their heads, and they were quite ready to start off for the Prah. Dr. Rowe came in, and I asked him, "Have "you seen this Ashantee?" "No," he said, "I have seen nothing; "it was your bugle that brought me back." I instance this, to show how much dependence could be placed upon the native allies that were with me, and who were supposed to be assisting us against the Ashantees. However, it required great caution to communicate with Lieutenant Barnard, because he having Akims and we having Akims, and the Akims and Ashantees being very much alike, there was great danger that we should fire into each other, and it took us some three and a half hours, although we were only three miles off, before we were able to join at Odumassie. At Odumassie we had to remain till ammunition and carriers came up. I mention this because I think, had I been allowed three or four days more over the Volta, I should have been enabled to have brought a much larger force up in time to assist Sir Garnet Wolseley before Coomassie.

We arrived at Odumassie on the 26th of January, and were then only 20 or 25 miles from Coomassie. One of our women prisoners told me that, starting from Odumassie in the morning with a load upon her head, she could reach Coomassie, and had often done it, in company with her mistress, by six in the evening; so that, on the 26th of January, we were within two marches of Coomassie. Three or four miles in front of Odumassie runs the Anoom river, and for ten miles the line of that river was held by the Ashantees, in great force. You will see two fords, one on the road leading to Duabin and the other to the left, by which we crossed and occupied the enemy's positions before we proceeded to Coomassie. I suppose the enemy must have been in great force in the camps which we occupied; they must have had 8,000 men on the Coomassie road, and some 2,000 on the road to Duabin.

On the 1st February I dispatched Captain Sartorius to endeavour to open a communication with Captain Butler's force, that was supposed to be operating half way between the General's and my own. Captain Sartorius crossed the Anoom as we had crossed the Prah, without having been discovered, and surprised, on the other bank, a picket of the enemy. He then marched a small force, only 130 men, through two camps. Of course, he was not aware that he was approaching these Ashantee camps, and, having got on to the first camp, he went into it before he knew where he was. The Ashantees were as much surprised as he was. Coming to the second camp, he did the same. You will then see that his rear was completely cut off, and that he might have been prevented from rejoining my force at Odumassie, so he dispatched 40 Houssas back, who went through these two camps with only one man wounded in the head, and they rejoined me at five in the evening. But very anxious I was about Captain Sartorius, and I sent Lieutenant Barnard at ten o'clock that night, with all the men I

could spare—only 150—to reinforce him. I wish there were time to read to you the very modest, almost misleading report of Captain Sartorius. I may say this—Captain Sartorius, having lost his way or having been misled by the Ashantee guide, returned, and thinking that he could not be in a safer place than near the enemy, encamped very close to their second large camp on the line of the Anoom river, intending, if he was prevented going through their camp the next morning, to cross the river and rejoin me. However, in the morning he heard the friendly sound of firing, and Lieutenant Barnard's force was coming up. They joined, drove the enemy out of their camp, and occupied it with their small force, having some four or five men killed and eleven wounded. I say, so modest and misleading was the report of Captain Sartorius, that it was not until I, with the main force, crossed the Anoom and occupied those camps, that I was at all aware of the difficulties that he and Lieutenant Barnard had had to overcome, not only from the enemy, but from the nature of the ground they passed over. They never ought to have got where they did; they never ought to have come back.

I was detained at Odumassie (only two marches from Coomassie), because we had not sufficient spare ammunition to go on with. I felt that, as soon as I left that place, I must make up my mind that all communication with my rear would be cut, and that I should obtain no further supplies. I was unaware where Sir Garnet Wolseley was. It was quite true my confidence in the General and also in the British troops he commanded, assured me that he would be in Coomassie on the day named, but still I had no communication with him and he had had none with me, except by the long route, nine days' journey south of the Prah, and therefore to go on with the small force I had, and with only enough ammunition to carry us through one or two days' fighting, was not to be thought of. However, on the 6th, Lieutenant Moore and 2,000 of the Aquapims and Croboes came in from the other side of the Volta, bringing up three guns, rockets, &c., and some 250 spare rounds of ammunition. In the mean time, news had reached me that Coomassie had fallen, but those who brought it, had not come from that place. It was only hearsay. A man who had been in Coomassie had told them, and they, being slaves, made their escape from a town near Duabin, and were endeavouring to make their way to my force when our scouts fell in with them. This information was not very reliable, but, having got the ammunition, we started on the 8th from Odumassie to join the General in Coomassie. On the morning of the 8th, messengers came from the King of Duabin offering his submission to the British Government, and stating that, as the King of Coomassie had been very foolish and had lost his town, it was not at all his intention to do the same, and therefore he begged I would accept his submission and send it on to the General. The Akims, whom I had left to watch the line of the Anoom on the road to Duabin, acting upon this, immediately started for Duabin, so that as soon as I was in Coomassie, they were in Duabin, although I was unaware of it. Having crossed the Anoom, I occupied the second Ashantee camp on the 8th. That camp was capable of containing

2,000 men, and the first camp 1,000. Starting the next morning we went some five miles, and, to our surprise and astonishment, came upon another large camp, which must have contained 5,000 men, so that there must have been 8,000 men on that road alone. Here we found corn and corn-flour; in fact, the whole line of march, from the camp on the Anoom, to the large camp and for several miles beyond it, was strewn with corn and corn-flour, which we benefited by, and our horses too. The day afterwards, we reached Essianimpon, and there we captured some Ashantee prisoners. One Ashantee prisoner was very much intoxicated and very troublesome, and therefore we kept him and put him in irons, but the others we let go. He informed us that the King of Ashantee was on our left, with a very large force. We had also captured a Houssa woman, who had told us that her son was one of a large force in camp on our right, so that we were between two large forces of the enemy.

Captain Sartorius having volunteered to take a despatch from me to the General so soon as I should find myself in a position to send it, I availed myself of his offer, and sent him on from the next place to meet the General. He had with him 20 picked Houssa men whom I could rely on; but so sure were we that the General was at Coomassie, and wishing Captain Sartorius to get into Coomassie that night, I sent them off with only forty rounds of ammunition in their pouches in order that they might march light. Had I known that the General was not there, I need hardly tell you that they would not have been sent at all. I kept the Ashantee before-mentioned till the morning. He told me the same account when he was sober, and I, therefore, concluded that his story was correct. You will, therefore, observe we had now got between the King of Ashantee and his capital. I gave Captain Sartorius time to communicate with me the next day, and then waiting two hours longer, and hearing nothing from him, I began to feel anxious; but my orders were *not to cross the Dah, nor to approach nearer Coomassie than ten miles without orders from the General*, and it was for that reason that Captain Sartorius was sent to communicate. However, finding he did not come back, I went on to look for him. We got into Coomassie about two o'clock the next day, viz., the 12th, and found it deserted, no signs of Captain Sartorius, and the place having a very disagreeable smell indeed, and the flies very troublesome, and also having heard that the King had accepted the terms of Sir Garnet, and that the first instalment of the gold had passed down, I felt there was nothing for me to do in Coomassie, although I should very much have liked to have remained there and to have visited the tombs of the kings and the country palace. It was not for me, however, to finish a work which Sir Garnet Wolseley had considered sufficiently done. I therefore followed the road down towards the coast, and very glad indeed I was to get on a good road, because our road hitherto had been a mere hunter's track; and although the route described from the camp at Adda to Coomassie is something under 200 miles, I suppose you may add another 150 to it for the usual turnings and twistings of a native road. About five miles from Coomassie (I need not describe the road to you, it is not a pleasant picture to put before you), I came to the burly

form of a man without his head, and, curious enough, he was very white. I at once said, "There's poor Sartorius." I rode on half a mile and fell in with a wounded Houssa man, whose thigh was broken. He was propped up against a tree, and had some bunches of plantains and calabashes of water, evidently some one had made him, under the circumstances, very comfortable. I told my Houssa men to make a hurdle for him, and to bring him down. I said, "Who gave you "these plantains?" "Oh," he said, "a white man passed here two "days ago with 20 Houssas." I need not describe to you the relief to my feelings, because that proved to me that it was not Captain Sartorius's body which I had seen headless on the road.

Our difficulties were now of course over, and on arriving at the Adansi Hills I was made aware, that the force I had left on the Anoom River had occupied Duabin. I received messengers from the King of Ashantee, conveying a very handsome gold salver and some fourteen ounces of gold, begging me to order my force at Daubin to withdraw across the Prah. I told them to take the gold back to the King, and as I had no orders to treat with any one, I would simply give him a copy of the instructions that I had received the day previous, which if he chose to send to my force, he might.

In the morning I sent for the messengers to have the letter, which I had written, read to them, and then it was that I discovered the cause of the King's anxiety that my force should be withdrawn. They were not where I had supposed them to be, on the Anoom; but they had occupied Duabin about the same time that I must have occupied Coomassie, and the reason the King of Ashantee was so very anxious they should be moved south of the Prah was, that they were inducing the King of Duabin to withdraw his allegiance from the King of Ashantee, which that chief has done subsequently, and is now, I believe, under British protection.

When the messengers returned with my letter, the King of Duabin cursed the King of Ashantee, and the King of Ashantee's messengers; and all the chiefs of the country lying to the eastward of Duabin and reaching to the Volta, have handed over the symbols of office which they received from the King of Ashantee, to the King of Akim, who was with me. The King of Duabin has given his niece in marriage to the King of Akim, and his sister as a pledge of his adhesion to the British Government, so that the whole country south of Coomassie has seceded from the King of Ashantee; and the whole country, not only east of Duabin to the Volta, but north-east up to a most important southern outpost of the Mahomedan power named Sallaga, has also fallen away from the King of Ashantee.

My private secretary, whom I left at Abogoo, and who was afterwards in communication with the force of the King of Duabin, has since informed me of the actual force which we held in check from co-operating against Sir Garnet Wolseley. I supposed that we had 10,000 men opposed to us on the line of the Anoom, but the entire force which the Kings of Duabin and Coomassie had in our front was not 10,000 but 20,000 men. I conclude, therefore, that we did some good service to Sir Garnet in withholding that force from attacking him.

When we were at Odumassie I wished the force at Connomo, which was then increased to some 2,000 men, to occupy the road leading to Duabin up to the line of the Anoom River. I supposed in the morning that this force had gone; I waited until mid-day, and having received no intelligence, I sent an Officer over to the King of Akim, to find if the force had gone. That Officer found the King and Chiefs in great council. The reason the force did not occupy that very limited line of road that day, nor indeed the day after, was this: one of the King of Akim's people in passing through Asuom, south of the Prah, had run against one of the fetish chiefs of that town and knocked him down. The King of Asuom on hearing this, immediately brought the King of Akim before a council in camp, and the decision of this great case as to what fine the King of Akim should pay to the Chief of Asuom on account of one of his men having knocked over this fetish priest, occupied two days. To give you another instance of our difficulty, when I got to Asuom, the chief of that place, the same troublesome man who fined the King of Akim, came into my camp and told me that one of my men had fired a gun off on a fetish day. There are four fetish days out of seven on which no work is done, no guns are allowed to be fired, and no one does anything but carouse; therefore, I must be fined. I told this chief we really had not come to be fined by him, and that under the circumstances, I should fine him, and as I was more in want of carriers than anything else, I fined him fifty carriers, and he said under the circumstances he supposed he must pay, which he did, partly in women. When I got up to his town, about a mile in advance, the fifty carriers were not produced. He sat down under one tree, and I sat down under another and had my breakfast. I then sent for him: he said he was very sorry, his people would not carry. I told him there were two ways of helping the Ashantees: one was by obstructing our advance, and the other by firing upon us; that I looked upon what he was doing as quite as obstructive as Ashantee hostility, that I should treat his town as an Ashantee town and burn it. He then thought better of it, went into the bush, cut a large stick, and with the assistance of his stick in about twenty minutes he had flogged out the men, produced some women, and I had my carriers. This man subsequently gave me great trouble after crossing the Prah, he took all these carriers away from me. One morning requiring carriers to carry the rockets which had come up I sent for this Chief of Asuom. He came, and exceedingly insolent he was. "Yes, he "had taken his people away, and meant to take them." I immediately ordered him to go to his camp and bring them out, he hesitated. There happened to be an old Ashantee chair near, and with the assistance of that applied to the small of his back, I persuaded him to fetch the carriers.

In conclusion, I dare say that you have seen the very able statement of the Secretary of State for the Colonies, as to the new government which is to be organized on the Gold Coast. There is to be a force of 1,000 Houssas. To show you the opinion the natives have of this Houssa force, I may state, whenever the King of Akim was in trouble about his people,

he used to come and say:—"Only give me two Houssas to go with "me and I will get you what you want," and having given him the two Houssas, the thing was done; the King not caring to go in by himself. I am sure the Officers who were with me, will all bear testimony to the élan, bravery, and good conduct of the Houssas; and doubtless there are many Military men present, who will understand me, when I describe them as the *Sikhs* of Africa. I do not know that I need trespass further upon the patience of the meeting.

The CHAIRMAN: Ladies and gentlemen, I am sure that you will all join with me in thanking Sir John Glover, for the highly interesting lecture that he has given us this afternoon. Though we have heard a good deal of the Ashantee Expedition, I believe that this is the first public occasion on which we have heard so many details of that branch of it which was under his able command. When we look round and see the large assembly that has met together here, it is manifest that the interest in that expedition has not abated; and I have no doubt that I only express your feelings in giving our cordial thanks to Sir John Glover for having given us so interesting an account of his expedition.

LECTURE.

Friday, June 12th, 1874.

THE RIGHT HON. GATHORNE HARDY, M.P., Secretary of State for War, in the Chair.

THE ASHANTI EXPEDITION OF 1873-4.*

By Colonel EVELYN WOOD, V.C., C.B., 90th Light Infantry.

MR. HARDY, LADIES AND GENTLEMEN,—On the 2nd October, 1873, Major-General Sir Garnet Wolseley, K.C.M.G., and the Officers who had volunteered for service in Africa, arrived on the Gold Coast, after an uncomfortable passage in a steam-ship, dirty and insufficiently provisioned.

Though I do not propose to go deeply into the history of the Protectorate, yet, in order to show the state of affairs on Sir Garnet Wolseley's arrival, it is necessary to glance at previous matters which had reduced Her Majesty's subjects on the Gold Coast to a pitiable state of panic.

From A.D. 1807 to 1827 the country adjacent to our ports and trading stations was overrun continually by Ashanti armies whenever the monarch of Coomassie ran short of slaves.

The hordes of savages were repulsed only on the coast line, till, on the 19th September, 1826, an Ashanti army was totally defeated at Dodowah, near Accra, by a Fanti force, led by British Officers, and the Ashantis then sued for peace, renouncing all rights to homage from Denkara, Assin and other formerly subject tribes. The treaty of peace was not finally arranged, however, till A.D. 1831, when it was signed by Governor Maclean, who had been sent out by a company of merchants, to whom the public establishments on the Gold Coast had been transferred by the Imperial Government, on hearing of Sir Charles Macarthy's disastrous action and death.

Governor Maclean's Administration was successful; but in justice to his less fortunate successors, it should be borne in mind that he assumed office immediately after the Ashantis had received a severe lesson from the action of the Imperial Government, and also that it is far easier to act as agent to a trading company than it is to represent the Government of Great Britain.

* For map, see Plate XV, page 317.

In A.D. 1843, it having been ascertained that the existing authorities favoured the slave trade, the Crown re-assumed the charge of our stations on the Gold Coast.

In 1852 the Imperial Government approved of a poll-tax being levied on the tribes of the Protectorate, "in consideration of the advantage of British protection;" and about this time the lesson of A.D. 1826 being apparently forgotten, the Ashantis recommenced a course of vexatious and insulting conduct, which was never met with the only argument they can appreciate—Force—till last year.

In 1863 an unfortunate expedition advanced to the Prah river, in order, it is stated, that we might regain the confidence of the Fantis in British protection; but after remaining for five months inactive on the river bank, the guns were buried, stores and ammunition destroyed, and the troops were withdrawn, more than 50 per cent. being sick.

About this time, Dutch and British settlements being interspersed, continual quarrels amongst the natives arose, and the two Powers, for the convenience of maintaining peace, carried out on the 1st January, 1868, an exchange of territory. In the exchange the natives were not consulted, and in the Convention dated the 5th of March, 1867, the whole of the country east of the Sweet River, up to the Ashanti frontier, is spoken of as "Her Majesty's possessions."

Two miles to the westward of the Sweet River is Elmina, inhabited by a small tribe, which peoples also the surrounding villages. For more than half a century, while Ashantis and Fantis were fighting, the relations of the Dutch and Elminese with the Ashantis continued on the most friendly footing. The Dutch wanted recruits for their Indian Colonies; the Ashantis had plenty of slaves to spare, and wanted ammunition, which the Dutch supplied.

The Elminese profited considerably by these transactions.

It is, therefore, plain that the Fantis would naturally dislike the Elminas; but in 1868-69-70 they had special causes of complaint.

Atjiempon, an Ashanti chief, generally, though erroneously, described as a Prince, had, in marching through the Protectorate, committed many atrocious outrages on Fantis, and was at this time located at Elmina.

The Fantis at Commendah, whom we transfirmed in A.D. 1868, refused to accept the Dutch flag, and killed or captured a boat's crew of their new masters, who bombarded and destroyed the town. The Dutch and Elminese living on amicable terms, their interests were considered to be identical, so the Fantis laid waste the country around Elmina, to avenge the destruction of Commendah.

The Elminese are so far superior to the Fantis in courage and discipline, that in spite of their immensely superior numbers, the mutual village burning and crop destroying exploits, in which the war consisted, might have gone on without any decided success, had not the Denkaras assisted the Fantis, who blockaded Elmina.

The Dutch, disgusted with the trouble arising from their new subject, especially at Commendah and Dix Cove, determined to transfer all their possessions to us. During the negotiations it transpired that the Dutch had for ages made a yearly payment to the Ashantis; but

the Dutch Governor led the English Governor to believe that the Elminese had no treaty with the Ashantis, who, moreover, had no claim to the territory or people of Elmina. We were further assured that the Elminese, if treated as heretofore, would raise no objection to the transfer.

Nevertheless, about this time the Ashanti King hearing of the proposed arrangements, put forward his claim; stating that when his ancestors conquered Denkara he paid the King of Denkara's debts amounting to £9,000 to the Dutch, who in return gave him Elmina.

It does not appear that the Elminese ever heard of this transaction.

Eventually the Dutch having sent an agent to Coomassie, Coffee Calcalli was reported to have withdrawn his claim, and the negotiations went on. Very soon, however, he wrote to our Governor, making various complaints; and in the same letter he urged for the Elminas claims for compensation for damages done by the Fantis.

He was desired not to interfere in the affairs of the Protectorate, and was also informed that until peace was made, he could not be allowed access to Elmina through our tribes.

The people of Elmina were separated into two parties, as much divided in their feelings as they were in their dwellings, which were situated on either side of the back-water Beyah.

The King's party consisting of about half the population, resided on the south side of the Beyah, and though not so averse to the British rule as might be expected when we consider how much they had suffered from the tribes protected by us, yet preferred the Ashantis. The natives on the north, or garden side of the water, consisted of mulattoes and the better educated classes. They were quite ready to accept the British flag, agreeing with the King's party only in detesting the Fantis.

Throughout the negotiations for the transfer, the British Government showest the strongest determination not to accept any territory which might in any way give rise to trouble with the natives. The Dutch were, however, anxious to quit the coast, so they arrested Atjiempon, whose continued residence at Elmina was a menace to the Fantis; and, as he declares, deposed the King of Elmina, who had objected strenuously to the transfer. This individual was present at the formal cession, 6th April, 1872, but denies having spoken on the occasion. A month later he was reinstated, without any pledge of his loyalty being required, and very soon he wrote to Coffee Calcalli to come to his assistance.

This monarch had been corresponding with the English Governor for some time. In 1869 Adoo Buffoo, an Ashanti General, carried off from Kreepee, east of the Volta, to Coomassie, four Europeans and one British subject, Mr. Palmer, of Accra. For these persons Coffee Calcalli had demanded a ransom of £6,000, which was afterwards reduced to £1,000.

He complained that the Assins were annoying Ashanti traders, which was probably correct; for the tribes of the Protectorate had not been attacked for some time, and the Fantis were becoming insolent, not only to their enemies, but also to us; some intriguing black politi-

cians resenting our disapproval of their hostilities against the Elminese, actually proposed to set up a Government independent of Great Britain.

It is evident that at this period our policy should have been firm, consistent, and suitable to the comprehension of savages.

I will narrate shortly what occurred.

1stly. We negotiated for the release on payment of the captured Europeans.

2ndly. We stopped the passage of munitions of war, and later debarred the Ashanti traders from the coast till the captives should be released. To this measure Coffee Calcalli replied by declaring there should be no peace till the ransom was paid.

3rdly. In April, 1872, to "show our friendship," we re-opened the roads to the Ashantis; offered to pay double the stipend paid by the Dutch at Elmina, and released Adoo Buffoo's son, who by chance was a prisoner at Cape Coast Castle, paying all his expenses back to Coomassie; and at the same time undertook to send for the Basle Mission £1,000 for the ransom of the captives seized by this youth's father. This sum was represented to be the "actual" expenses incurred for the prisoners' subsistence, which at an outside estimate could not have exceeded £200. Impartial people will probably agree with the Basle Mission, that we treated the Ashantis better than the Swiss.

4thly. We sent back to Coomassie, in "a manner becoming his rank," with 700 followers, the monster, Atjiempon, who it is said once flayed a Fanti alive, and told him to look at the skin of his back. Atjiempon reached home just in time to command one of the invading Armies, and Adoo Buffoo, on recovering his son, gave his vote to the war party in Coomassie which he had previously opposed, while fearful for his son's safety. Our language was, if possible, more conciliatory than our measures. On learning that Coffee Calcalli would accept £1,000 for his captives, we "hastened to thank him for his good faith and friendliness."

Meanwhile, though it was known early in November, 1872, at Cape Coast Castle that the Ashanti Army was assembling, we took no measures to guard against invasion.

In January, 1873, the Ashantis crossed the Prah, killing the men, carrying off the women and children, and burning the Fanti villages. Nevertheless, on the 12th February, the report of the invasion was discredited at the seat of Government, Sierra Leone.

At Elmina, however, the full significance of the news was understood, and the restored King became joyous at the approach of his friends, while the loyal Elminas were proportionably depressed.

In and about the town, were three or four hundred Ashantis, who had remained there on Atjiempon's departure, and on the 28th February, Chief Esseive, whose loyalty never faltered, pointing out that the "Garden Party" had no confidence that the British Government would support them if the Ashantis joined with the King's party should attack them, begged that an oath of allegiance might be administered to all the Chiefs, and that the Ashantis might be

removed. Both these apparently reasonable requests were refused, though it was known a month earlier that the King's party had promised to join the Ashantis, and a fortnight later the King was deported to Sierra Leone.

The Ashantis, moving southwards, attacked the Fantis who had been induced by Surgeon-Major Rowe to form a camp between Yancoomassie Fanti and Dunquah. The Fanti Army numbered 57,000 men, the Ashanti 34,000, if all who crossed the Prah were present.

Each Army was encamped on a hill, from which the bush had been cleared, and the battle, described in the official report as a "terrific "fight, lasting many hours," consisted in the boldest spirits on either side descending to the thick jungle which covered the intervening valley, firing away enormous quantities of ammunition and retiring; neither Army would advance up to the cleared ground. The Fantis are said to have lost about one man in every 300 killed, and one per centum wounded. They never fought so well again.

On the 14th April, they were again induced by Dr. Rowe to open fire, but his brave subordinates, Messrs. Loggie and McKellar, could not succeed in "flogging" them to the front. Next morning the Fantis retreated and did nothing more for the liberation of their country.

The Ashantis remained at Dunquah till the 14th May, when they moved very slowly, though quite unopposed, to the westward. On the 5th June they drove a Fanti force from Jooquah, and sending emissaries to Elmina advanced a force of about 3,000 men to the hills near that town.

On the 9th June, Lieutenant-Colonel Festing, with 100 marines, having arrived, it was decided to disarm the King's party, and the following arrangements were made in conjunction with Captain Fremantle, the Senior Naval Officer.

At 6 A.M. on the 13th June, the neck of land on which the King's party lived, was encircled by the Houssas being sent along the beach towards Fort de Vere, the fleet's boats being sent up the Beyah, while as many soldiers of the 2nd West India Regiment as could be spared, connected the sailors in the boats with the Haussas.

Martial law having been proclaimed, notices were issued that all arms were to be brought to the Castle. At noon, as it was evident there was no intention of complying with the order, the town was shelled and destroyed, the inhabitants passing out to the westward under cover of some palm trees and scrub.

It was now reported that the ejected inhabitants, joined with Ashantis, were advancing, and Colonel Festing moved to Fort de Vere and after a skirmish drove back the enemy, capturing a flag. Our casualties, so far, were but one killed and three wounded out of 500 men employed. The fire from the boats must have been extremely well managed, or it would have been destructive to our own people, as it was necessarily directed towards where the Haussas were stationed.

In the evening when, as it was supposed, the Ashantis had left the neighbourhood, and all the boats except the "Barracouta's" had gone off to their ships, Mr. Hamel, the Dutch Vice-Consul, ran to the Castle with the news that a large body of Ashantis, estimated at 2,000 men,

was moving across the plain towards the loyal part of the town. Colonel Festing at once got his troops under arms, and having, from the top of St. Jago, viewed the enemy's advance, himself repaired to Java Hill that he might be near the troops, which he placed as follows:—

The marines under cover of, but outside the western wall of the garden which gave its name to the loyal side of the town. Next to them the Houssas, and on the left the 2nd West India soldiers. Lieutenant Wells had been directed to hurry up and cover the right flank.

The Ashantis came on in crowds, covered by skirmishers, some few of whom had crossed the northern wall and were crossing the garden, when they were astounded by meeting our sailors running towards them. On leaving the boats Lieutenant Wells had moved along the beach till he came near the garden, when, hearing the firing, he hurried up and arrived so opportunely.

The few Ashantis in the garden turned and ran back till they reached the mass of Ashantis, now about 100 yards from the wall. There the Chiefs and their followers stood in a confused column, scarcely firing, and apparently undecided what to do, while our people from under cover poured in several volleys. Presently the Ashantis turned and fell back, yet slowly and in good order. Colonel Festing saw the crisis was past, and advancing his force he pushed the enemy for two miles across the plain. When the Ashantis attempted to re-form near the bush he dispersed them with a few volleys. Our casualties were one man killed and four wounded out of 330 of all ranks engaged. The Ashantis had it is said over 2,000 men killed, but had the guns in St. Jago commanding the plain opened fire, as Colonel Festing ordered, the enemy's loss would have been much greater.

The result of this action appears to have influenced the Ashantis immensely, and in the campaign which followed they never assailed fortified positions with the vigour they showed 50 years ago, though they certainly exhibited great bravery in withstanding our attacks.

For three months and a half, our only movements were the reconnaisances made by Lieutenant Gordon, 98th Regiment, who unassisted by any of the marines then on the coast, approached the enemy's camp, cut roads, and built the redoubts at Napoleon and Abbaye. It is worthy of observation as showing what a man may effect by force of character, irrespective of rank, that when the "Ambriz" arrived off the coast "Lieutenant Gordon," was the answer to nearly every question of "Who did that?"

The reconnaisances effected by this Officer established the truth of previous reports, that after their defeat at Elmina the Ashantis retired to Mampon, Effootoo, and Essiam, villages about 15 miles from the coast, where they remained undisturbed by us till after Sir Garnet Wolesley's arrival; for although an attack on their camp was proposed, the senior military Officer very wisely declined to undertake so hazardous and foolhardy an operation with the resources then at his command. His decision was approved by all his superiors. Reading the correspondence that passed on this subject and about the organization of a proposed expedition to Coomassie with the light of subse-

quent experience, the sound judgment displayed by the senior military Officer appears to great advantage.

Sir Garnet Wolseley having arrived, instantly set to work. He had left two Officers at Sierra Leone, who raised about 200 men. An Officer sent to the "Gambia" recruited seven men only, though using every possible exertion. It was decided to raise two native corps, known as Russell's and Wood's Regiment, and some Haussa gunners, who were named Rait's Artillery.

Officers were dispatched to all the Fanti Kings to draw out their men, while the Head-quarter Staff commenced the organization of an Intelligence Department and the arrangement and improvement of our topographical information; and this was essential, for outside a radius of 10 or 12 miles from our forts, we apparently had no military knowledge.

Early in October, Sir Garnet Wolseley determined to stop the supplies by which the Chiefs of the Ashanti Army were fed from Elmina and the adjacent villages. The Officer commanding at Elmina, acting under instructions, summoned the head men to attend before him with promise of safe conducts.

Written notices were sent, and messengers chosen from the King's party were dispatched to ensure the summonses being understood. The attitude of these Chiefs was characteristic of their confidence in the safety or otherwise of their respective positions.

A Chief from the nearest village on the Elmina plain came in. He of Essaman replied, "Come and fetch me; white man no dare go "bush." From Ampeene no answer was received, but the villagers mutilating, decapitated a loyal native, and exposed the body on the beach. The Chief of Amquana sent word, "I have small-pox to-day "but will come to-morrow." He never appeared, and as we learnt later went instead to Mampon.

At 4 A.M., on the 14th October, Sir Garnet Wolseley, his Staff, Captain Fremantle, some white and black troops, landed at Elmina; and at 5 A.M. 180 white men and 330 black soldiers marched on Essaman in the following order:—

Haussas, under Lieutenant Richmond.
16 2nd West India men, under Lieutenant Eyre. } Wood's Regt.
30 axemen, under Captain Buller, D.A.Q.M.G.

50 sailors and marine artillery, with 7-lb. gun and rocket tube, under Captain Fremantle.

The marines, under Captain Crease.

2nd West India, under Captain Forbes.

Ammunition and hammock-bearers.

2nd West India, rear-guard, under Captain Brett.

So well had our preparations been concealed, that when parading, only the Commanding Officer at Elmina knew the General's intention.

For an hour our path lay across a marshy plain, often covered with water; once we had to wade knee-deep for 100 yards. On either hand were wooded undulations, and the shrubs on either side of the path were covered with beautiful creepers; purple, red, and bright yellow convolvuli met the eye every moment. Further on, the bush, which as

yet was in patches only, became denser, and occasionally we traversed defiles which, if held by an enemy, must have cost us many lives. The path was but 8 or 10 inches wide, though it had been generally cleared of undergrowth for 2 or 3 feet.

We were near Essaman, when at 7 A.M. the column or string of men received a volley from invisible enemies, generally 100 yards distant, but occasionally from braver spirits, lying in bushes close to the path. One of these, who mortally wounded a Haussa, must have almost touched him, so little had the slugs spread in the Haussa's body.

The enemy were on every side, but would not close. The atmosphere around a cleared hillock, where the 2nd West India soldiers and hammocks were ordered to form up, became dense with smoke. The dull, heavy sound of the long, over-loaded Dane gun and blunderbuss used by the Ashantis; the sharp crack of the Sniders, the screeching of the rockets, the shouts of Officers, oft overpowered by the triumphant, long-drawn yells of "a Haussa man," which were occasionally silenced by the deep roar of the 7-pounder gun, intensified by the closeness of the surrounding bush, all this for half an hour made up a scene it is impossible adequately to depict.

The Special Service Officers were serving under the immediate eye of their General, whose choice they apparently wished to justify, for they ventured their lives freely. The General left the immediate command of the troops to the Commandant of Elmina, and thus himself and the Head-quarter Staff having no definite duties, were free to enjoy themselves, which they did by leading the advance with a lively audacity which, while exciting admiration, caused some uneasiness to those who reflected on the nature of the void their fall might create.

Led by these Staff Officers the column pressed on, and we never again during the campaign advanced so rapidly on the foe. The village was fired by our shells and abandoned by the enemy, as Captain Brackenbury and Lieutenant Charteris led some marines into it. The surprise was complete. No effects had been removed, and the loss to the enemy in provisions and powder, which exploded continually, being kept in the houses, was very great.

Having rested an hour, we set out for Amquana, distant about four or five miles. We were scarcely in motion before some few Ashantis opened fire, and the Haussas responded by a reckless waste of ammunition. Fortunately we now had a few marines in advance, who walking quietly along with their rifles "at the slope," presently disappeared round a bend in the path, and the Haussas suddenly perceiving the absurdity of their proceedings followed their white companions.

After leaving the ruined village of Inkrapoor, destroyed by the Denkaras in the 1869–70 war, we entered some thick and lofty bush. The trees were higher and thicker than in an English copse, but not like those further inland. We could generally see about 30 yards on either side of the path, which lay a foot or so below the surface of the ground, and was often several inches deep in black mud. This made our march slow and painful, and all were greatly relieved when we reached Amquana, situated on the beach. Its small-pox stricken Chief, with his people, had deserted the village, which was destroyed.

It was now 12 noon and the heat was intense, as indeed it had been since 8 o'clock, wherever the sun reached our heads. At 2 o'clock 30 Europeans and 250 natives moved on to Akimfoo and Ampenee, which were burnt. At the latter place only was any resistance offered, and that not of a serious nature.

Our casualties were 2 men killed and 23 Officers and men wounded, and the entire distance marched was over 22 miles.

I have dwelt longer on this affair than its actual importance warrants.

1st. Because its being our first successful fight in African bush, the experience was very valuable; and,

2ndly. Because, great as was the effect on the Ashantis, the moral effect on the coast was far greater.

For months we had left the tribes under our protection almost entirely to themselves, till they had ceased to believe in our courage or power to oppose the enemy. It is true we had sent an Officer to Dunquah to give "every moral aid" to the Fantis, and he was to succour the Assins if he could; but later he had been directed "not "to make any movements with the Haussas endangering their direct "and safe concentration." Such extraordinary orders are not unusual in Africa, for we learnt after the campaign that a monarch who sent us a contingent of fighting men strictly enjoined their commander, his brother, not to venture under fire on any account, whatever the white Officers might say.

The present generation of Fantis had never seen a fighting Governor, one who himself led troops. Cowardly as they are, they appreciate courage; and the Elminas, a much braver race, were won over that day. Early in September it was reported officially, "not a man in "Elmina has taken up a gun against the enemy." On the 14th October two Chiefs with some followers guided the troops, and never left the Officer whom they joined till Coomassie was taken.

The enemy now began to move slowly northwards, and Lieutenant Richmond (50th Regiment) of Wood's Regiment, walked through a long line of camps near Essiam, on the 26th October, finding but few Ashantis, who fled on his approach.

From this time the operations were carried on in dense forests of gigantic trees, often 200 feet high, laced together with creepers supporting foliage so thick as to shut out the sun. There were few flowers, but, except around villages, the undergrowth was not so thick as near the coast. It was, however, close to villages that most of the fighting occurred, where the system of African cultivation afforded good cover to our enemies. Clearing the ground by fire, they sow in the ashes, and when the soil is exhausted they abandon the spot for another clearing. On these deserted fields there rises lofty vegetation, impenetrable save to naked savages, who crawl through it on their faces.

On the 27th October, Colonel Festing moved out from Dunquah on the Haunted Road, with twelve Officers, a gun, rocket tube, and 700 natives, 80 of whom belonged to the 2nd West India Regiment.

An opportune and very heavy thunderstorm enabled him to approach unheard a camp at Escabio, three miles from Dunquah. The Ashantis were surprised cooking, and fled in confusion into the bush, where, however, they lay, firing on our people, notwithstanding the rounds of grape poured into their covert. They dared not venture out, even while their camp was being destroyed, but their passive courage in sustaining fire was remarkable. The 2nd West India men and the Anamaboes behaved well—all the other natives disgracefully. Our casualties were one man killed and 50 wounded, most of whom were but slightly injured.

Next day the Major-General led a reconnaissance of 500 men, half being Europeans, from Abrakampa to Assanchi, directing Colonel Festing to move towards him at the same time. Colonel Festing, however, could not induce his allies to move out, and Sir Garnet found the Ashantis had moved from Assanchi.

On the 3rd November reconnaissances were made from all our advanced posts, that from Dunquah in force under Colonel Festing, who had with him 1,100 men, 60 belonging to the 2nd West India Regiment. This time the Ashantis were on the alert, and but little progress was made. Lieutenant Eardley Wilmot, R.A., was wounded in the shoulder almost at once, but with devoted courage continued to lead the advance till he was shot dead, the foremost man. After two hours' fighting, the Ashantis threatened the rear, and we retired, with the loss of two killed and 68 wounded, the gallant Commander being hit by a slug as he was bringing Lieutenant Wilmot's body from the front of the column, towards the rear.

At Escabio, on the 27th, the allies were driven into action by blows. On this occasion three tribes ran back *en masse* when the firing commenced.

Meanwhile smaller parties were moving from Abrakampa and Beulah. That from Abrakampa, composed of Haussas and Winnebahs, came on the enemy, who were not in great force. Nevertheless, and despite the noble example set them by Lieutenant Gordon and Lord Gifford, they ran away: so terrified were they, that the Officers were knocked down and trampled on the earth.

The party from Beulah was induced by the gallant bearing of the late Lieutenant Eyre, who always marched in front of all, to advance to the enemy's camp at Essecroom, which was found to be deserted. There the sight of some dead and dying Ashantis so alarmed the Cape Coast men, that they could not be forced past the corpses save by the greater terror of a loaded pistol held to their heads. It is well to state plainly these facts culled from the official dispatches, for if remembered, they may save us some valuable lives in our next West African campaign; for unless our duties are strictly defined, and our liabilities are greatly curtailed, I regard another expedition as inevitable.

Two days later the natives appeared to greater advantage in, for them, the more congenial task of lying behind intrenchments and expending ammunition. Amanquatsia was anxious to strike a blow before leaving the Protectorate, and about three o'clock on the 5th November, a day of good omen for Englishmen on the defensive, the Ashantis drove in a picket to the west of Abrakampa, and, with tumul-

tuous shouting, endeavoured to break out of the bush and advance on the village. Fortunately for the Abras, a most determined soldier, Major Baker Russell, was in the little missionary town, having under him 60 white men, 100 Haussas, 300 of Russell's and Wood's Regiments, and 450 allies; in all 1,000 men. The bush had been cleared for 100 yards around the houses; shelter trenches had been thrown up; the houses were loopholed, the angles of the town protected by abattis, and the church offered a good citadel. About five o'clock the firing slackened, for a time, but only to recommence with renewed vigour, the Ashantis this time coming on more to the south of the village. Again and again the leaders ran forward and cheered on their men, but without effect. Once only did they come on in a body, and then some 200, having assembled in an adjacent valley in the bush, came ont performing a war dance. It chanced that, concealed from them by a slight hillock, but outside the shelter trench, lay a company of the 2nd West India Regiment, under Captain Grant. Pouring in a volley at 60 yards, they arose, and cheering, ran at the Ashantis, who breaking, fled like sheep back into the bush. Till midnight, powder was expended, and then the firing gradually died away. Next day the attack was renewed, but with much less vigour, and in the evening the Major-General, with 300 white men from the fleet arrived.

On the 7th November 1,000 Cape Coast men, who had been directed by Colonel Wood to join him at Essecroom, arrived at Abrakampa, in order, as they said, to fight under the General's eye. At 2 P.M. they were paraded, facing the bush, and a more extraordinary battle array was never seen. In the British Army, corps quarrel for the position on the right of the line: here each company struggled for and edged away to the left, I imagine because it was the point further removed from the Ashantis. In front was a line of stalwart men, bigger than the Ashantis, all well armed with Enfield Rifles. Behind them were their Chiefs with whips. Behind the Fanti Chiefs were Kossoos with drawn swords. When ordered to advance the Fantis moved forward a dozen paces and then stopped. The Chiefs belaboured all within reach; and the Kossoos menaced the most backward, including many of the Chiefs. In time all but the Kings were out of sight, and they showed no intention of venturing into the bush, till some Officers who were looking on, having been forbidden to go forward, "used more than "verbal persuasion," to quote the words of a despatch; and indeed one gifted Officer used so much persuasion towards a Chief as to spoil a strong umbrella. Yelling and firing, the Cape Coast men advanced as the ever menacing Kossoos closed on them. Once in the bush, however, they were more at liberty, and squatting down, they let the Abras pass to their right. These, on reaching Anismadi, the Ashanti Camp, observed the last of Amanquatsia's army moving off. Not anticipating an attack, they had left much spoil and many slaves in camp, and several fell into our hands, though some were slaughtered in sight of the Abras, one Ashanti being shot while actually cutting a young mother's throat, a baby being on her back.

On the 8th November Captain Bromhead conducted a reconnaissance

with the Haussas, Kossoos, and Cape Coast men, and coming on a rear guard of the enemy at Ainsa, was unable to move them. Retiring, he was pursued, and left the Cape Coast men to cover the movement. They did not approve of this, and, panic stricken, they fired into each other, killing over twenty of their own people; then rushing over the Haussas, who were crossing a stream, they drowned one man by trampling him under water. They never ceased running till they reached Cape Coast, 20 miles distant, where they dispersed. As the General wrote, "their duplicity and cowardice surpass all description."

We now lost sight of the Ashantis for three weeks, for though over 3,000 of our allies were collected between Dunquah and Mansu, they absolutely declined to approach the enemy. It was, however, ascertained from stragglers that Amanquatsia was retiring on paths he was cutting parallel to our line of advance.

The Ashantis approached the main path at Mansu, where a redoubt had been erected by the Commanding Royal Engineer. He had but 43 natives with him, untrained Fantis, with only 40 rounds of ammunition per man. Nevertheless, although he was ordered to retire towards the Coast, he held his ground, and the enemy were forced to move in the bush further to the north before they could gain the main path.

We occupied Sutah on the 26th November, the Ashantis having regained the Prahsu track at that place, which their rear guard quitted on the 25th November. Next morning 300 men, 100 being Haussas, 23 2nd West India, and the remainder Wood's Regiment, left Sutah for Faisowah, where, as it was believed, stragglers only would be found. Still all precautions were taken, the men of Wood's Regiment being the best available, Kossoos, and the Elmina Company, in which were 25 Haussa-Ashanti slaves taken in previous reconnaissances; while the Fanti Company was left at Sutah to bring up the baggage when carriers could be obtained from the Assin camps in the neighbourhood.

It happened that Amanquatsia's rear guard of 4,000 men had been reinforced on the 25th by 5,000 troops from Coomassie, who had been sent down with orders to re-take the offensive.

At 2 P.M. our advanced guard was fired on half a mile south of Faisoo, and the Ashanti rear picket was driven across the river and from the open ground of Faisowah. The Kossoos and the Elmina Company were extended into the bush on either side of the path, whence they fired into an immense camp, and, as it afterwards transpired, with considerable effect. Several rockets also were well aimed by the three Marine Artillerymen, whose cool courageous bearing it was a pleasure to witness.

Colonel Wood had no reserve ammunition, for at that time no carriers had been allotted to regiments, and when he had held the open ground for over half an hour, observing the Ashantis were closing in to the rear of his flanks, he directed the Haussas then in reserve to extend, while the Kossoos and the Elminas passed through them.

For a mile the movement was carried out in excellent order, but south of Faisoo some carriers coming up with loads, and the Fanti Company of Wood's Regiment arriving as a reinforcement, became

panic stricken without coming under fire. Throwing down their loads, they fled, and this so unsteadied the greater part of the Kossoos and Haussas that they hurried along eleven in a row, overlapping the path, which, as we advanced, was broad enough for one man only. The Elmina Company only, under Lieutenant Richmond, kept its ranks, allowing others to rush by it.

Lieutenants Gordon (93rd), Woodgate (4th Regiment), and Pollard, R.N., held some men together, and with them kept back the Ashantis who followed the little force for three miles. The casualties were very slight, being one killed, eight wounded, and four missing, men who fled into the bush and re-appeared, one a month later. The difficulties of this march were much increased by the path being in many places knee-deep in water, which extended in one part over 900 yards. That night the Ashantis, fearing that a large force was pressing on them, retired by torchlight, and on the 29th November began to cross the Prah. In the words of an official document, penned by the Major-General in January, when the results were well-known—"This attack "caused the whole of the Ashanti Army to retreat in the utmost haste "and confusion, leaving their dead and dying everywhere along the "path."

Road-making and bush-cutting now went on apace, and on the 16th December Wood's Regiment began the clearing at Prahsu, being joined a week later by Russell's Regiment. For a month the work was continued—acres of palm-leaves for thatching, thousands of poles for uprights, were collected by these soldiers, and transformed by natives under the never-ceasing supervision of two or three Engineer Officers, into lofty huts, all provided with bamboo guard beds.

Sir Garnet Wolseley and his Staff arrived at Prahsu on the 2nd January, 1874, and about this time we learnt that Amanquatsia's Army had been disbanded at Coomassie on the 22nd December. No one will ever know, probably, what his losses were, but one of the European captives counted 79 boxes containing the bones of Chiefs carried into the city, and it is supposed rather more than half of the Ashanti Army perished in the Protectorate, mainly from dysentery and small-pox.

The day head-quarters were established on the Prah, a messenger came from Calcalli, but it did not appear that the Ashantis would accept our terms, though negotiations were continued up to the time of our last fight.

The plan of the invasion of Ashanti now became known. We were to cross the Prah on the 15th January at four points on the circumference of an arc of about 70 miles, and to advance converging on Coomassie. On the extreme right stood Captain Glover, whose base was on the Volta; next stood Captain Butler who hoped to induce 2,000 Western Akims to cross with him about 35 miles to the east of the Major-General. Captain Dalrymple was to urge the Wassaws to advance from the Denkara country.

To save future reference, I will anticipate events.

No efforts could move the Wassaws. Captain Butler, after heart-breaking delays, crossed the Prah with three European Officers and

one Fanti policeman. Eventually he persuaded 500 Akims to follow him to Yankoma through a deserted and devastated country, but at night their courage failed them, and leaving the Europeans, they fled back across the Prah. Yet the Akims were said to be the most warlike tribe of the Protectorate.

It would be a mistake to value these abortive demonstrations, and Captain Glover's gallant and successful advance, according only to the number of Ashantis detached to watch the threatened roads.

The Ashanti monarch is supported by powerful feudatories, and the war being unpopular with those Chiefs who had fought against white men south of the Prah, they gladly seized the excuse of their territories being invaded, to diminish their contingents ordered up to defend the capital.

Sir John Glover has narrated the history of the Expedition he so ably commanded, and so I shall only allude to it.

In doing so, I wish to express the high admiration felt for him by those Officers who, having led comparatively small bodies of natives with several Europeans, can appreciate his difficulties when the proportions of Officers and men were reversed. It is improbable that the present generation will see on the Gold Coast any equal to Sir John Glover; whether we consider his determined courage, his abilities, his long experience of, and immense influence over the natives, or the iron constitution which, with an indomitable will, has enabled him to withstand the evil influences of a detestable climate. This being the case it is important to consider how our allies treated him that we may cherish no more illusions.

On the 14th December, 1873, Captain Glover reported to the Major-General that he would, as directed, be on the Prah by the 15th January; and that the force with which he would cross might reach to 30,000, and would not be less than 16,000 men.

On the 22nd December he reported he feared there was no possibility of his reaching the Prah for 40 days, *i.e.*, the first week in February.

The speedy withdrawal of the white regiments from the Coast being essential, the General was constrained to direct that the invasion should be commenced on the appointed day, if with the Haussas and Yombas only, who numbered about 800 effectives. Captain Glover disapproved of this, and, pointing out how much his usefulness would be impaired if he crossed as ordered by Sir Garnet Wolseley, stated he could not be responsible for the result. Nevertheless, he loyally carried out his instructions, and crossed the Prah at 12 noon on the 15th January. Assuming that the Chiefs kept their promises for the first time perhaps, on record, Captain Glover's crossing in February, as he proposed, would have been coincident with the fall of Coomassie, and the Juabin Chief, who was frightened by his advance into submission, would have been able to aid Coffee Calcalli in opposing the Major-General at Coomassie. Thus Sir Garnet Wolseley's decision appears to have led to the best results for both columns.

It is impossible to allude to Captain Glover's force without noticing with the deepest admiration one of the most daring acts of the war in Captain Sartorius's march. Sent on to Coomassie to communicate

with the Major-General, and failing to find him, he marched with 20 Haussas 50 miles through the heart of the enemy's country.

On the 1st January, 1874, the disembarkation of the Europeans was commenced. Half a battalion was to move forward each day, the first reaching Prahsu, 74 miles distant, in eight days; but on the fifth day, hundreds of the carriers deserting, not only near the coast, but along the line, it seemed that our advance must come to an end. We need not go far for the explanation. The African is sensual, indolent, and cowardly. The white men were about to cross the Prah, where there would be less food, and more danger.

Our policy had removed all power from the Kings, who neither could, nor apparently would move a finger to help us. Thus a King was regarded by the Officers as a useless black man, who required food, but who would neither fight nor carry a load.

Chibbo and Inki, when offered European Officers to train their subjects the Assins replied, "No! our hearts are not big enough to fight as "your Officers would require." Now a Chief at Dunquah was arrested for inciting carriers to desert. In the words of a despatch, "Too "cowardly to fight their own battles, and too lazy, even when well paid, "to help those who are risking their lives in their cause, they were "(have been) deserting by whole tribes."

Our soldiers, white and black, were behaving very differently. The West India and Wood's Regiment became carriers, marching 16 miles a day, carrying a load half the distance. The white soldiers evinced a noble spirit. One regiment did actually carry loads for a day or two, till the General hearing of it, though fully appreciating such efforts, forbad the exertions which would have destroyed our fighting power in a week. The other battalions vied with each other in offering to carry loads, and subsist on half rations, if allowed to go the front. Eventually, mainly by Colonel Colley's exertions, the runaways were recovered; other labour was collected by force, and the advance was continued to the Prah, the white soldiers enjoying such luxurious comfort as was never before seen in any campaign.

In each encampment there were huts for the Officers and men, all provided with comfortable beds; filtered water, pumps, washing places, latrines, cooking places, sentry-boxes, control stores, a hospital, and surgery. At Mansu greater accommodation was provided for the effective and the sick soldiers. With a force of 1,500 Europeans, 70 per cent. passed under the care of the medical staff; so many had to bless the never-ceasing kindness and attention bestowed on us.

I can never forget the more than human kindness of the gentleman* attached to Wood's Regiment, who, ever in the front in action, never took food nor laid down to rest till he had looked to the well being of all those serving with him. The two senior Officers who were in succession in chief charge of the department, and their subordinates, were happy in possessing that calm courage in action, which is so re-assuring to the wounded, and consolatory to the dying soldier.

Major Home, R.E., and his Officers had made a smooth road, varying

* Surgeon-Major Charles Mosse, C.B.

from 8 to 12 feet wide; had put up 237 bridges; had laid down corduroy over innumerable swamps, some of which required three tiers of fascines, and one bit alone, between Sutah and Faisowah, stretched 800 yards. No Officers ever worked harder, or with more unsatisfactory labour.

On the 5th January, 1874, the Engineers completed a bridge over the Prah, and a company of scouts carefully organised by Captain Buller, went forward under a young nobleman, who well maintained the honour of his order. Right gallantly he performed his task, "carrying his life "in his hand" for days together. In justice, however, to Lieutenant Gordon and the late Lieutenant Eyre, who did most of the scouting south of the Prah, it should be borne in mind that they had no scouts, properly so called, under them, and had to reconnoitre with Haussas, and other strangers in the land. The majority of the scouts now moved forward were Assins, the only tribe speaking Ashanti without accent. These selected men were nearly all hunters by profession; they were thoroughly acquainted with the country up to the Adansi hills, and many knew every village up to Coomassie. Some dozen Haussas and Kossoos, chosen for their courage, and a few West India soldiers, made up the party.

Covered by this party, Russell's Regiment crossed the Prah on the 5th January, and, followed ten days later by the other native corps, reached the Adansi hills without any fighting, the King of Adansi, Obin, having directed his men not to fire on us.

The native regiments carried from eight to ten days' rations, thereby relieving the control considerably, but this would have been impossible had our advance been opposed.

On the 25th January, head-quarters were in Fommanah, the scouts on the Bahrein river, and the rear of the field force was at Essiaman. At Fommanah the General halted four days, Coffee Calcalli pretending to negotiate while we required time to bring up our supplies.

On the 26th, a reconnoitring party being fired on at Adubiassie, two miles west of the main path, the village was burnt.

It was now ascertained that the Ashantis were collecting at Amoaful, while Obin's men, the Adansis, were at Borborassie, about seven miles to the westward of Kiang Boasu. Colonel McLeod proceeded to this village on the 29th January, with the Naval Brigade, one company 23rd Fusiliers, and the Anamaboe company of Russell's Regiment. There was but little or no resistance at first, the 23rd advancing in the centre, not having a man hurt; partly, perhaps, because the Adansis were surprised, and partly because their chief wished to join our Protectorate. We learnt later that Coffee Calcalli had sent Essamanquatsia to watch Obin, whose views were well known at Coomassie.

On the right of the village, Captain Nicol, commanding the Anamaboes, a brave and experienced Officer, approached a group of villagers who were standing quietly near their houses. He was endeavouring to convey to them that they must retire, when a savage from behind a house shot him dead. The Anamaboes poured in a volley, and the villagers fled.

It has been said that the orders issued to save bloodshed, that our people should not fire first, caused indirectly this brave Officer's life. It is clear that the men whom Captain Nicol approached, knew nothing of intended treachery, or they would not have remained so quietly before the Anamaboes, who shot six as they fled in all directions, when poor Nicol fell. Neither could so brave and humane a man as Captain Nicol, with or without orders, fire into a crowd of unresisting men.

Our people now halted to breakfast, and the news was sent back by a party of Anamaboes, who were waylaid, one or two being killed, and three wounded.

After an hour's halt, the column returned, followed by the enemy, who were driven off, however, by the sailors acting as rear guard, with a steadiness worthy of veteran troops. Three sailors were wounded.

On the evening of the 30th January, the Ashanti army under Amanquatsia and several great Chiefs, was drawn up south of Amoaful, with its main body on a swampy stream which crosses the main path, 600 yards north of Egginassie.

The black brigade, consisting of Russell's, Rait's, and Wood's Regiments, was at Quarman, 1,000 yards south of Egginassie, and the white men were in and about Insanfoo.

The study of previous battles, and the experience gained in the minor actions of the previous four months, showed plainly that the Ashanti tactics are ever the same. The centre is refused, while sweeping turning movements are made on the flanks. There is for naked and hardy warriors in thick forests, little of the danger which in Europe would be incurred by such tactics; for unclothed, without baggage, they can always retreat on their hands and knees through the tangled underwood, and re-form, almost unmolested by Europeans.

By the following arrangement every precaution was taken by the Major-General to insure success, and, backed by the brilliant courage of his soldiers, his triumph was complete.

The troops were divided into four commands.

The front column consisted of—

2 7-pounder guns,
The 42nd Highlanders, } Brigadier-General Sir A. Alison, Bart., C.B.

Left Column.

100 men of the Naval Brigade,
Russell's Regiment,
2 Rocket Detachments, } Colonel McLeod, C.B.

Right Column.

100 men Naval Brigade,
Wood's Regiment,
2 Rocket Detachments, } Lieut.-Colonel Evelyn Wood, V.C.

Reserve.

1 Company 23rd Regiment. Lieut.-Colonel Mostyn.

Rear Column.

2nd Battalion Rifle Brigade, Lieut.-Colonel Warren.

IRREGULAR F

PAGINATION

from 8 to 12 feet wide; had put up 237 bridges; had laid down corduroy over innumerable swamps, some of which required three tiers of fascines, and one bit alone, between Sutah and Faisowah, stretched 800 yards. No Officers ever worked harder, or with more unsatisfactory labour.

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On the 25th January, head-quarters were in Fommanah, the scouts on the Bahrein river, and the rear of the field force was at Essiaman. At Fommanah the General halted four days, Coffee Calcalli pretending to negotiate while we required time to bring up our supplies.

On the 26th, a reconnoitring party being fired on at Adubiassie, two miles west of the main path, the village was burnt.

It was now ascertained that the Ashantis were collecting at Amoaful, while Obin's men, the Adansis, were at Borborassie, about seven miles to the westward of Kiang Boasu. Colonel McLeod proceeded to this village on the 29th January, with the Naval Brigade, one company 23rd Fusiliers, and the Anamaboe company of Russell's Regiment. There was but little or no resistance at first, the 23rd advancing in the centre, not having a man hurt; partly, perhaps, because the Adansis were surprised, and partly because their chief wished to join our Protectorate. We learnt later that Coffee Calcalli had sent Essamanquatsia to watch Obin, whose views were well known at Coomassie.

On the right of the village, Captain Nicol, commanding the Anamaboes, a brave and experienced Officer, approached a group of villagers who were standing quietly near their houses. He was endeavouring to convey to them that they must retire, when a savage from behind a house shot him dead. The Anamaboes poured in a volley, and the villagers fled.

It has been said that the orders issued to save bloodshed, that our people should not fire first, caused indirectly this brave Officer's life. It is clear that the men whom Captain Nicol approached, knew nothing of intended treachery, or they would not have remained so quietly before the Anamaboes, who shot six as they fled in all directions, when poor Nicol fell. Neither could so brave and humane a man as Captain Nicol, with or without orders, fire into a crowd of unresisting men.

Our people now halted to breakfast, and the news was sent back by a party of Anamaboes, who were waylaid, one or two being killed, and three wounded.

After an hour's halt, the column returned, followed by the enemy, who were driven off, however, by the sailors acting as rear guard, with a steadiness worthy of veteran troops. Three sailors were wounded.

On the evening of the 30th January, the Ashanti army under Amanquatsia and several great Chiefs, was drawn up south of Amoaful, with its main body on a swampy stream which crosses the main path, 600 yards north of Egginassie.

The black brigade, consisting of Russell's, Rait's, and Wood's Regiments, was at Quarman, 1,000 yards south of Egginassie, and the white men were in and about Insanfoo.

The study of previous battles, and the experience gained in the minor actions of the previous four months, showed plainly that the Ashanti tactics are ever the same. The centre is refused, while sweeping turning movements are made on the flanks. There is for naked and hardy warriors in thick forests, little of the danger which in Europe would be incurred by such tactics; for unclothed, without baggage, they can always retreat on their hands and knees through the tangled underwood, and re-form, almost unmolested by Europeans.

By the following arrangement every precaution was taken by the Major-General to insure success, and, backed by the brilliant courage of his soldiers, his triumph was complete.

The troops were divided into four commands.

The front column consisted of—

2 7-pounder guns, } Brigadier-General
The 42nd Highlanders, } Sir A. Alison, Bart., C.B.

Left Column.

100 men of the Naval Brigade, }
Russell's Regiment, } Colonel McLeod, C.B.
2 Rocket Detachments, }

Right Column.

100 men Naval Brigade, }
Wood's Regiment, } Lieut.-Colonel Evelyn Wood, V.C.
2 Rocket Detachments, }

Reserve.

1 Company 23rd Regiment. Lieut.-Colonel Mostyn.

Rear Column.

2nd Battalion Rifle Brigade, Lieut.-Colonel Warren.

The front and flank columns were accompanied by Sierra Leone labourers, who, inspired by the daring courage of the Engineer Officers leading them, continued to cut the bush in the very fore-front of the fight, till their Officers were struck down. Of the three so employed, one was killed, one was wounded, and the third escaped only because "his day of Destiny was not yet come."

The front column, having met the enemy, was to extend, if possible, 300 yards on either side of the path, on which the guns were to move. The flank columns were to cut paths diagonally outwards, and then to advance parallel with the main path, keeping up the connection with the 42nd if feasible. The rear column was to maintain the line of communications, guard the ammunition and wounded, and reinforce any point when necessary.

At 7.30 A.M. on the 31st January the 42nd Highlanders marched through Quarman, on Egginassie, with heads erect and shoulders thrown back. The other column closed up, but our rate of progression was slow, as each command was followed by its hammocks and ammunition.

At 8 o'clock Lord Gifford ran into Egginassie, the Ashanti scouts firing and falling back on the main body. Three companies of the 42nd now went forward on the main path, and two on the track leading to the westward.

On the banks of the stream the enemy made a determined stand, and the Black Watch gained ground only from their indomitable courage and the gallant leading of Officers and Non-commissioned Officers, in whom, by a perfect regimental system, the chain of responsibility is fully developed.

At length the Ashantis began to give way; brave as they are, they were staggered by seeing men advance in spite of their comrades falling, and the sight of the white men closing, appalled them more than the hottest fire. In these movements the 42nd was greatly assisted by one of Rait's guns, which was continually pushed on in line with the leading men. Gaining ground twenty yards at a time, and coming into action, Rait cleared the enemy from the immediate vicinity of the path, and as each discharge swept away the foe, some sections of the Highlanders rushing forward, secured the ground thus won.

About noon the enemy were shelled out of Amoaful, the Black Watch carrying the town after four hours' fighting, with their pipers playing ahead of the regiment.

The left column, on arriving at Egginassie, moved to the westward, on the track previously followed by the two companies of the 42nd, and having made a clearing due west of the village, in securing which the Haussa and Opobo companies of Russell's Regiment made a splendid advance, turned northward, and endeavoured to regain touch with the 42nd. This was found to be impossible; and after sustaining a heavy fire, in which Captain Buckle was killed while encouraging his labourers to clear the bush, this column regained the main path just as Amoaful was taken.

The head of the right column followed the 42nd for 150 yards

beyond Egginassie, when a path was cut for 100 yards in a north-easterly direction. Here the Ashantis held their ground in scrubby undergrowth of a disused plantation, which was unusually thick. Our force at this point consisted at first of 100 of the Naval Brigade and rocket detachment of Rait's artillery, for the main portions of Wood's Regiment had been halted south of Egginassie, while the best company, the Elminas, had been sent to the westward to support the left column.

The 42nd in their dashing advance had left on their right flank a considerable number of Ashantis, many of whom, determined savages, penetrated into the angle of uncut bush, between the main path and Colonel Wood's track. Lying flat on the ground, they were as invisible as a hare on her form, till they fired. The Naval Brigade men were further embarrassed, by the fear of injuring our people on the main path. Progress being arrested here, the gap between the right column and the 42nd became wider, and was filled eventually by the company 23rd, and a company of the Rifle Brigade, each being warmly engaged. Little ground was gained, however, till 1.30 P.M., when the Bonnys and Kossoos of Wood's Regiment, charged up the hill east of Egginassie, and, assisted by the Naval and Rifle Brigade, drove off the enemy.

At two o'clock, when complete success having been attained in front, all firing had ceased, the enemy made a serious attack from the south-west on Quarman; and later, on a strongly escorted convoy north of Insanfoo.

They were repulsed, however, from Quarman by the garrison composed of 12 Royal Engineers and some of the 2nd West India Regiment reinforced later by the Rifle Brigade; and about nightfall they were driven off the line of our communications, chiefly owing to the determined energy of Colonel Colley.

Two thousand men were engaged and 130 Officers; and seven or eight were killed or mortally hurt, 21 Officers and 170 men being wounded. The 42nd suffered most severely, having nine Officers and 106 men killed or wounded. Several natives slightly wounded being treated by their comrades, were not returned in the list.

It is difficult to compute the enemy's loss. A European Officer counted 163 bodies buried in one trench on the plateau of Amoaful, but considerable surprise was felt that more bodies were not seen in the bush, till next morning an Officer moving out to the flank, came on several rows of dead men laid out in a dell, whose bodies had evidently been carried out of the fight for burial. It is said that Amanquatsia was killed, and the King of Mampon, a powerful chief living to the north-east of Coomassie, was wounded.

That night head-quarters were at Amoaful. Next morning a force moved under Sir A. Alison to Bekwa, which was destroyed by the advanced guard under Colonel McLeod. We heard that the gallant Lord Gifford penetrated with his scouts unsupported into the town, the Haussas declining to go forward though their Officers tried their utmost to induce them to advance. Like all irregulars, they are sub-

ject to panics, and cannot, certainly until they are well drilled, and led by Officers speaking their language, be trusted to make an orderly retrograde movement before an enterprising enemy; but hitherto they had attacked with spirit.

On the 2nd of February head-quarters moved to Aggemum, the advance being continually but feebly opposed by the enemy, who, firing frequently from ambush, wounded very slightly three Officers.

This day also Essamanquatsia made a determined attack on Fommanah, the garrison being commanded by Captain North, 47th Regiment, till he was severely wounded; then by Captain Duncan, R.A., and later by Colonel Colley, who managed to see nearly every fight north of the Prah.

Arrived at Aggemum our position was one of great difficulty. We had but four days' rations, and Coomassie was known to be still 16 miles distant; there was a considerable sized river in our front, and it was certain that the Ashantis would make another effort to defend the capital. Most Generals would have hesitated in such a conjuncture, but with a happy audacity Sir Garnet Wolseley pressed on, and the result proved the wisdom of his decision.

The troops accepted joyfully four days' food for six days, and carrying nothing but ammunition, they bivouacked on the evening of the 3rd of February on the Ordah, the black brigade crossing to protect the Engineers, who during the night formed a good firm bridge.

The seven mile march had been delayed by the Ashantis a little north of Adwabin, where, as indeed through the day, Russell's Regiment is reported to have done very well. The previous day they had been replaced in the advanced guard by the Rifle Brigade, on account of their wasteful expenditure of ammunition, as were the Bonnys of Wood's Regiment on the following day.

There was in my opinion a tendency in the minds of Officers who had just arrived at the front, to expect too much from these native regiments. It was no doubt difficult for those who had marched up on smooth roads, into comfortable camps, to realise what the so-called native soldiers had done for the white men. The European regiments had glorious traditions, perfect regimental system, experienced Non-commissioned Officers, and one Officer for every 18 men, and never taking any night duties, they enjoyed their full vigour.

The native regiments were composed of four or five different races, no company understanding the language of that working near to it, and no men speaking the language of their Officers, who were in the proportion of one to every 40 men. Except in Rait's artillery, there were no Non-commissioned Officers. Rait's artillery always did well. In justice, however, to others, we should remember that the artillery had the pick of all the Haussas—that they never did any pioneer work, and that being admirably drilled by European Non-commissioned Officers, they had in action a European Officer to every 10 natives.

Russell's and Wood's Regiments took all the light infantry duties,

but the latter especially, were never drilled. Wood's Regiment marched incessantly from its formation till it was disbanded. After being at the head of the road for six weeks, the day it was relieved to teach the men how to fire off their rifles, the whole regiment instead of being drilled, became carriers. Thus the Bonny company of Wood's Regiment, which led the advance at Ordasu, had never realised the advantage to be gained by placing a rifle in the shoulder before discharging it.

When our men were advancing on the Dah some more messengers arrived during a temporary cessation of fire, crying out, "Mercy, oh," as with bodies bent forward to escape chance shots, they ran up to the scouts.

It was night before the rear guard reached their bivouac, and as the sun went down, the sky clouded over, and till 2 A.M., torrents of rain fell on the Officers and men, who had neither great coats nor shelter of any kind. The troops showed on this occasion the same noble endurance as a smaller but more severely tried detachment evinced on the same ground two nights later. A convoy of sixty wounded Europeans returning from Coomassie reached the Dah at 5 P.M. Scarcely was the bivouac arranged, when a tornado burst on them, and for 12 hours expended its fury on the unfortunate soldiers. Water ran out of their hammocks in streams. The incessant blinding rain extinguished the fires which the Officers lit for their men; but throughout the night not a complaint, not a murmur was heard.

At 6.30 A.M. on the 4th February, the hostages whose arrival had been promised by the messengers of the previous day, had not arrived, and our last day's fighting began.

The Bonny men and head-quarters of Wood's Regiment marching throughout the night had come up from Egginassie at 4 A.M., and now led the advance. They were followed by two companies of the Rifle Brigade and a 7-pounder gun.

We were scarcely in motion, when the Ashanti pickets fired, and in ten minutes the advance was hotly engaged. Though the Ashantis never pressed on us as at Amoaful, some brave savages were ambushed close to the path, a few being killed within four yards of us, whose presence we never detected till they fired, so easily were their dusky bodies concealed.

Lieutenant Saunders brought a gun to the extreme front and fired into the enemy at very close range, but the Ashantis stood fast.

The path, like all tracks on soft soil, was worn down a little below the general surface of the ground, and the rise on either side afforded cover to men crouching down at full length. Some few Bonny men were induced by their Officers and Chief Essevie of Elmina, who behaved very well, to fire steadily from the knee, but most of them, in spite of much "more than verbal persuasion," remained flat on their faces, firing in the air, without daring to raise their heads from the ground.

On the right flank, and about 500 yards from the river, a gulley approached the path; crawling up this and firing in safety, the

Ashantis inflicted on us some slight loss, till a company of riflemen, going through the bush, drove them off.

The advance was now continued, and about 9 o'clock, the village of Ordasu was carried by the Rifle Brigade with but little resistance.

The bush was immediately cleared around the village, and it was well this precaution was taken, for in an hour the Ashantis who had been making partial attacks all along the line of advance, enveloped the clearing on three sides, with a steady fire.

At half-past eleven, the head-quarters came up, and the baggage was passed from the river through the ranks up to the village. For the next hour there was a continual roar of musketry, the enemy's slugs reaching us but not with sufficient force to do any injury, the Major-General being hit on the helmet.

About 12 noon Colonel McLeod, relinquishing the command of the black brigade, rejoined the Black Watch which was to press forward to Coomassie, disregarding all flank attacks. On debouching from the village, a volley from an ambuscade knocked over six men, but a company on either side worked round it, while a third, in the path, sprang forward with a cheer, and the pipes striking up, the ambuscade was carried.

At first, while the opposition was considerable, the skirmishing companies passed through each other, gaining 50 yards at a time. When the village whence the King had issued his orders was carried, all resistance ceased, and the 42nd pressed on to the capital.

Meanwhile the Ashantis continued their attack on Ordasu till it concluded in a dramatic and remarkable manner.

A report having been received from Sir A. Alison, who had gone on with the 42nd, that the enemy were flying, panic-stricken, before the Highlanders, a Staff Officer went round to inform the corps defending the village, who presently raised a vigorous cheer. The firing ceased as if by magic, the enemy withdrawing in silence.

The whole force moved on, and at 6 o'clock Sir Garnet Wolseley, taking off his helmet in the market-place of Coomassie, called on the Black Watch formed in dressed ranks on parade, to give three cheers for Her Majesty.

In conclusion, I would briefly recall the first general aspect of the campaign as contrasted with its results.

The failures of the past threw a deeper shadow over the untrodden gloom of the forest. There were no monuments of achieved victory to encourage the successors of Macarthy.

Our small Army had to hew its way through density deep as death, and redolent of its decay, to the charnel-house called Coomassie. Malaria fought in the van of the Ashantis, and the sickening feeling of debility, which must be felt to be understood, made a formidable and sympathetic alliance with a covert and subtle enemy.

In an open country, our soldiers have always met odds with a light heart, but it is well for us they still possess the firm qualities which distinguished them under Lord Seale in the time of Ferdinand and Isabella, when the Spanish chronicler described them "as men slow to "find out when they are beaten." These qualities enabled our small

force to maintain a steady heart and aim in the front of that harassing enemy whose strength lay in his invisibility, and whose hidden aim was protected by the strenuous forces of Nature.

We should not forget the cloud of evil auguries under which the expedition sailed. Success was deemed impossible; critics differed, it is true, as to the causes of anticipated disasters, but nearly all predicted failure. How different was the result! but in attaining such a result, some of the brightest, bravest spirits of our time were rendered up, not grudgingly, as by men who do an unpalatable duty, nor recklessly, as by those to whom life offers small attractions.

The men who are in my thoughts now, and whose epitaphs are written in the memory of their country, gave up the pleasures natural to their years in the ambition to serve in a gallant enterprise. The campaign which at once sacrificed and immortalised such men as Wilmot, Charteris, Nicol, Eyre, and Buckle, and others of the bright host who live in the manner of their death, could not have been inglorious even in frustration.

That it did not so end must be, in part, attributed to the spirit which animated the forces and rendered them, like red-hot iron, fervent but pliable in the hands of the master workman, and in part to the directing power of the master workman, of whom may be said, as was said by Scott of Napoleon, "He was a Sovereign among soldiers." His means were limited by time and circumstances; with a handful of men he was required to accomplish a hitherto unattainable feat. In six months, he had to re-establish our reputation lowered by successive humiliations and failures, and to read a lesson in letters of fire to the arrogant and bloodthirsty race who had defied us so long by their weapons of Distance, Disease, and Treachery.

It is true of Sir Garnet Wolseley as was written of Pitt—

"Few men made fewer mistakes, nor left so few advantages unim-
"proved." To all his other great qualities he joined that fire, that spirit, that courage, which, giving vigour and direction to his soldiers, bore down all resistance.

In fine, our success was due to the leader and his choice of able subordinates who all acknowledged their Chief's superior military genius, as they loyally supported him in everything, and he impressed on all his iron will, and steadfast determination to take Coomassie.

The CHAIRMAN: Ladies and Gentlemen, after the most interesting and graphic account which we have received of the late campaign, I am sure you will all unite with me in tendering our heartiest thanks to Colonel Wood for the great treat he has afforded us. It is indeed a pleasure that in a United Service Institution you should hear from one who has taken part in that short but most splendid campaign. the generous sympathy which one part of the Service shows for the other; and I am quite sure that this meeting will feel, that though they heard little in these details of Colonel Wood, still in the absence of mention of himself he has not been forgotten by the country. I will not detain you longer, but I am sure I shall have your hearty sympathy in requesting you to give your thanks to Colonel Wood.

Evening Meeting.

Monday, May 18th, 1874.

VICE-ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B., Vice-President, in the Chair.

NAMES of MEMBERS who joined the Institution between the 4th and 18th of May, 1874.

LIFE.

McCleverty, James, Lieutenant 45th Regiment.
Arnold, Stanley, Captain Royal Lancashire Artillery Militia.

ANNUAL.

Godbold, G. A. B., Lieutenant 12th Regiment.
Wingfield, Geo. T., Lieutenant R.N.
Wilmot, Sir Henry, Bart., C.C., M.P., Lieut.-Colonel Derby R.V., late R.B.
Gooch, Geo. T., Captain R.N.
Clarke, William, Major-General, Unatt.
Wavell, A. H., Major 41st Regiment.
McDougall, W. B., Lt. 78th Highlanders.
Kellie, James, Lieutenant R.E.
Macdonald, William, Major 12th Bengal Native Infantry.

THREE YEARS WITH THE ROYAL NAVAL RESERVE.

By Commander HARRY W. BRENT, R.N.

ADMIRAL SHERARD OSBORN, in his recent pamphlet on "Impressment," having placed prominently before the country the necessity of keeping the Reserves for the Royal Navy up to their full standard, and the want of a militia for Naval service when necessary, besides, as I have been, for the last three years, serving with the Royal Naval Reserve, I wish to give you to-night some account of the men, their drills and discipline, such as I found them, with the result of my observations and opinion of their value. There are, probably, some here to-night who know more about the Reserve than I do; to them I apologise, as this paper simply contains the story of the regulations, and the account of daily life in a drill-ship. I also regret I have no scheme to put forward for filling the ranks of the Reserve, and for rendering it so expansive that it might be doubled in time of war.

All that I shall state is what has come within my own knowledge, so that what I happen to know respecting the men of the Royal Naval Reserve may be known to naval Officers who have never served with that force, and under whom these Reserve men must serve in the case of war, whatever they may be worth. A maritime war would see many ships put in commission—some, it is quite possible, with half-a-dozen man-of-war's-men, and the mass of the crew Reserve men; a superficial knowledge even of the men under their orders therefore is of use, a knowledge which may create great trust, and if so, great strength; it

may create distrust, but if so, being prepared for such a weakness, will I hope, lessen its evils.

No one can in this day, I take it, gainsay the value of Reserves to our standing Forces; the Reserves for the Navy attract, somehow, but little attention; still the necessity of such Forces is as great as it possibly can be.

Our ships and number of men are on a peace establishment, we have no means of suddenly putting a large fleet to sea except by calling out the Reserves, therefore the well-being and efficiency of those Reserves becomes of great importance; they will surely some day be wanted, and, it has struck me, this fact of being called on to serve in the Navy is never strongly before either naval Officers or Reserve men. I would put it before both on every possible occasion, making the Reserve man feel he was a part of England's Royal Navy, no higher boast, and Officers that these are the men who will surely some day be under their orders, it may be, in their country's peril.

During my service with the Reserve, I strove, according to my belief of right, to make the drill-ship a man-of-war, and the Reserve man feel he belonged to the Royal Navy, not of course always successfully, but I think steadily gaining ground. The Reserve man in my opinion, as yet does not realise that naval Officers have even at times, any charge of him, his feelings all clinging to the Mercantile Marine Office, and that there are his Officers; but as time goes on, I hope this feeling will die out, and that the men will each year become better acquainted with naval Officers, and more and more amenable to what I am sure is at first a little strange to them.

The principle on which the drill was carried out, was the same as for a newly-commissioned ship—progressive instruction, silence, attention, and quickness, being of all things determined on; from first to last the Reserve man was never allowed to speak, and made to go as hard as he could. When I say this, I must at once state, on all points connected with drill I found the mass of the men pay great attention, and try to do everything that was required of them. There were thirteen cases of inattention in the three years—a fact, in my opinion, that speaks well for the men, the instructors not being at all those who would pass faults over.

I will now follow out what happens to the men on entering the Reserve, on coming to the drill-ship, the drills they have to perform, their pay and allowances, discipline and prospects. From the facts connected with these points, I hope those unacquainted with the force may be able to form some opinion regarding it, and leave this with an acquaintance with men who may at any time be serving in the fleet.

The Royal Naval Reserve is governed both by the Admiralty and by the Board of Trade, the Admiralty taking charge of all the drills; the Board of Trade of all that relates to the man being retained ready for service when wanted.

The Department of the Board of Trade immediately over the Reserve is ruled by the Registrar-General of Seamen, that of the Admiralty is ruled by the Second Naval Lord; all round the coasts the Registrar-

General is represented by the Superintendents of the Mercantile Marine at the principal ports, and by the Custom-house officials at smaller places, who are Registrars of the Naval Reserve; while the Admiralty Department is represented by the Captains of the district ships, the Commanders of the drill-ships, and the Coast-Guard Officers at out-of-the-way places. Whenever the Reserve man enters, he is examined and passed by the representatives of the two State Departments, and is always coming in contact with either one or the other of them; and yet matters are so well arranged, the two never clash. Each Reserve man has a number and book; in the book the Registrar enters the merchant ships he sails in, and the payment of all retaining fees; in it also, the naval Officer enters all the drills performed, and the gratuitous clothing issued to the man. Nothing can be done without this book, the Registrar will not pay retainers unless certain drill is entered, or allow a man to join a ship without its being produced, and the naval Officer allows no drill to be performed except the book shows it is the proper time.

To the Superintendents of Mercantile Marine and Collectors of Customs at the various ports, the strength of the Reserve is practically due, and on them will the numerical strength always more or less depend. Naval Officers may do much to increase or decrease the numbers of men belonging to it, but their influence is as nothing compared with the representatives of the Board of Trade—they, and they only, come across the men wanted, they see them when ships' articles are signed, and crews are always paid off in their presence; they keep the Merchant Seaman's Savings Banks, pay remittance notes, remit money from paid-off crews to their homes, and do all this quietly, but in the best interests of the men. The Mercantile Marine Offices are places little known of, but there much work is, and has been done by the civil servants of the Crown for the well-being of those in whom they come in contact.

A naval Officer might go to a seaport barely seeing a merchant seaman, while the Registrar is not only seeing him almost daily, but knows about those who live at the place, being *en rapport* with the seafaring population around him.

The Registrar obtains the man for the Reserve; when entered, the naval Officer instructs and perfects him—the one recruits, the other drills; and so a force to be drafted into the Navy in time of war is in the hands of the Government.

On seeing what may be called "likely men," the Registrar puts before them all that is required of them if they join the Reserve. Great care is taken that only the best men of the mercantile marine are obtained; those who are well known, and who are certain in their voyages and have fixed residences, are preferred; their movements being certain, the Registrar-General can calculate to a day when they will be ready for service in the fleet.

The 1st Class Reserve man must be under 30 years of age, unless he has been in the Royal Navy, when he may be entered under 35; he must produce certificates of good character, and prove that he has at least five years' sea service during the last ten years, with not less than

one of these five as an able seaman. The 2nd Class Reserve man must be between 19 and 30 years of age, and prove that for three years he has followed a seafaring life, of these six months as ordinary seaman. Apprentices who have completed three years of their indentures, and fishermen, can be taken for this class.

The Registrar reads to the man the rules, explains what drill he must perform yearly and what voyages he can take; how at certain periods he can take longer voyages, provided he has done so much drill; that he must dress himself for drill in a decent suit of dark blue clothing if a 1st Class man, and in the uniform provided for him if a 2nd Class man, and take care to let no small matter escape the man's attention, especially as to penalties. The man, when he perfectly understands what is required of him, signs a declaration that he is willing to serve in the Reserve for a period of five years, and is then sent with this declaration to the nearest naval Officer.

On arriving at, we will say, a drill-ship, the man is measured to see that he is of the standard height (5 feet 4 inches), and is then medically examined—an examination as a rule, by a Senior Staff Surgeon, and exactly the same as any man for entry into the Navy.

In 1871, of 47 first entries, 2 were medically rejected; in 1872, of 68 first entries, 3 were rejected; in 1873, of 79 first entries, 3 were rejected; and in 1874, of 31 first entries, 2 were rejected.

Having passed the medical examination, the man is examined in seamanship, and as sometimes men are accepted who have a difficulty in proving their sea service, great care has to be taken with the 1st Class Reserve, that a *bonâ fide* able seaman, one who can hand, reef, and steer, is obtained; for 2nd Class, the seamanship required is simply to steer, pull a good strong oar, and to box the compass, and there is therefore but little trouble in their examination; but the examination of the 1st Class men was upon the following points:—

Passing an earring.
Steering with the wheel.
Boxing the compass.
Taking the lead.
  Swinging it.
  Marking it.
Knotting and splicing, and making all necessary hitches and bends.
Passing a stopper on a cable or fall.
Strapping a block.
Turning in a dead-eye.
Racking a lanyard.
Using a parbuckle.
Reeving running-rigging fore and aft.
Using a palm and needle.
Working a cringle.
Pulling a good strong oar.

Out of 176 men for the 1st Class Reserve examined in the three years, 123 received 1st Class certificates, 43 received 2nd Class certifi-

cates, 10 received 3rd Class certificates, and no man was rejected for want of seamanship qualification. A 1st Class certificate was given to all men with "very good" on all points; a 2nd Class, some points "very good" and others "good;" a 3rd Class, some points "very good," the mass "good," and some "fair." There was one thing that few could do, that was to swing the lead overhand; looking at this as purely a naval trick, I never made a man lose a 1st Class certificate for not being able to do so; excepting this, I found them all to compare most favourably with A.B.'s in the Navy, especially as to sewing a seam.

The examination I have quoted is one not directly ordered, but naval Officers having to see that able seamen are entered, I adopted this to meet the case; the result in my opinion is, that we have in the 1st Class Reserve a thorough body of sailor men. For the 2nd Class Reserve I never pressed a very strict examination as to knowledge of the compass, the few I saw being unmistakably seafaring men; though their knowledge of the compass was of the most limited nature, I accepted them.

The *physique* of the men is good. I had them weighed and their height taken in 1871, 1872, and 1873 as follows:—Of 100 men coming on drill in 1871 the average height was 5 feet 5 inches; average weight 10 stone 9 lbs.; the maximum height and weight combined in the same man, 5 feet 10½ inches and 13 stone; the minimum height 5 feet 1½ inches, with a weight of 10 stone, and the minimum weight 8 stone 11 lbs. with a height of 5 feet 5½ inches.

In 1872, of 100 men coming on drill, the average height was 5 feet 6 inches, and the average weight 10 stone 10 lbs.; the maximum height and weight combined in the same man, 6 feet 1½ inches and 13 stone; minimum height 5 feet 2½ inches with a weight of 9 stone 10 lbs., and minimum weight 9 stone 1 lb., with a height of 5 feet 3 inches.

I next, in 1872, had 100 men coming on drill not only weighed and measured, but their chests measured in the usual way, with the following results:—Average height 5 feet 6 inches, average weight 10 stone 5 lbs., average chest measurement 35½ inches; maximum height and weight combined in the same man, 6 feet 2 inches and 14 stone 3 lbs., with chest measurement of 38½ inches; maximum chest measurement 39 inches, with a height of 5 feet 11 inches, and weight of 11 stone 7 lbs.; minimum height 5 feet 2 inches, with weight of 10 stone 8 lbs., and chest measurement of 36 inches; minimum weight and chest measurement combined in the same man 8 stone 8 lbs. and 24 inches, with a height of 5 feet 3½ inches.

In 1872 I also took 100 men enrolling and re-enrolling, and had them weighed and measured in the same way as follows:—

Average height 5 feet 6 inches, average weight 10 stone 6 lbs., average chest measurement 35½ inches; maximum height 6 feet 2 inches, with weight of 12 stone 7 lbs., and chest measurement of 39 inches; maximum weight and chest measurement combined in the same man, 13 stone and 39½ inches, with height of 5 feet 11 inches; minimum height 5 feet 3 inches, with weight of 9 stone 8 lbs., and chest measurement 34 inches; minimum weight and chest measurement

combined in the same man, 9 stone 4 lbs. and 34 inches, with height of 5 feet 6½ inches.

In 1873 I had the same measurements taken of 100 men as they came on drill, as follows:—Average height, 5 feet 6 inches; average weight, 10 stone 10 lbs.; average chest measurement, 35 inches; maximum height, weight, and chest measurement combined in the same man, 5 feet 11½ inches, 16 stone 2 lbs., and 41 inches; minimum height, 5 feet 1 inch, with weight of 11 stone 7 lbs., and chest measurement of 37½ inches; minimum weight, 8 stone 9 lbs., with height of 5 feet 3 inches, and chest measurement of 33½ inches; minimum chest measurement 32½ inches, with height of 5 feet 5 inches, and weight of 9 stone 12 lbs.

These weights and measurements give the size of the men that came before me. I did not continue it to 1874, as probably I should have taken the same men more than once. Some weighed and measured were already in the Force, others joining for the first time. I think it gives a very good idea of the size of the men. As a rule, all I saw were stout, strapping fellows who could well pull their "pound."

The Reserve man having been entered, can commence drill in which he is instructed in heavy and truck gun, rifle and sword, firing 2 rounds at gun practice and 15 rounds at rifle practice in each month's drill.

In the drill-ships where, as a rule, the greatest number of men drill —in fact the main places for carrying out the instruction of the Reserve—the complement is, one Commander, Staff-Surgeon and Paymaster; two Gunners, one for the ship, the other for drill; three Gunnery Instructors, three Seamen Gunners, in winter six Seamen Gunners in addition, besides some able seamen, artificers, and one or two others. I look on the drill-ship as not only a school of gunnery but also as a school of naval manners and customs, teaching men that they are under discipline, which would show them exactly what would be expected of them if called out for service in the Fleet.

The Reserve man being entered, when it suits him goes to the drill-ship, to be while there a man-of-war's-man; he has to drill 28 days in each year, and in this bears the same relation to the Navy, that the Militiaman bears to the Army. The Reserve man, unlike the Militiaman who is called out for the whole 28 days at once, may divide the 28 days into four parts of seven days each after his first drill, which must be for a fortnight; he is allowed to do so because of the exigencies of a merchant seaman's life, as he can rarely tell when he can spare the time; but 28 days' drill must be performed in each year unless he has permission to stay away from England, and in that case, on his return he must make up arrears, and may have to drill for six weeks or two months in one year. The whole time of engagement is for five years, and during that time five yearly drills of 28 days each have to be performed; it is imperative that this is performed, as, though getting paid weekly while on drill, there must be a week's drill performed for each quarter of the year before the man can be paid his retainer.

The Reserve men receive the following pay and allowances, provided

the regulations are complied with, and the required drill performed:—Each 1st Class man receives a uniform cap on enrolment and re-enrolment, a retaining fee of £6 a-year, paid in quarterly retainers of 30*s.* each; the pay for each week's drill is £1 1*s.*, or 3*s.* a-day, divided thus: 1*s.* 4*d.* a-day as A.B. non-continuous service, 1*s.* 4*d.* a-day for provisions, and 4*d.* a-day for lodgings. Trained men get 1*d.* a-day in addition, that each man has £10 4*s.* a-year, and if trained, £10 6*s.* 4*d.* The 2nd Class man receives a retaining fee of £2 10*s.* a-year, paid in quarterly retainers of 12*s.* 6*d.* each, and a suit of uniform clothing yearly, consisting of blue cloth trowsers, serge frock, checked shirt with collar, black silk handkerchief and cap; the pay for each week's drill is 19*s.* 3*d.*, or 2*s.* 9*d.* a-day, divided thus:—1*s.* 1*d.* a-day as ordinary seamen non-continuous service, 1*s.* 4*d.* a-day for provisions, and 4*d.* a-day for lodgings; that each man has a suit of clothes and £6 7*s.* a-year, and if trained £6 9*s.* 4*d.* The retainers are paid quarterly, provided a week's drill has been performed for the quarter, and this is the fee that retains the man for the service of the Crown, it is paid by the Registrars and entered in the man's book.

The Reserve man coming on board the drill-ship to perform a month, or part of a month's drill, has the ship's orders read to him, as follows:—

I.

During the time the men of the Royal Naval Reserve are attending their drills, they are to remember that they are subject to the same discipline as the men of the Royal Navy. See Book, page 60, Article 60.

II.

They are to be punctual in their attendance at drill, and are not to absent themselves without their instructor takes them to the gunner for leave. In case of sickness, they are to send to the ship to acquaint the surgeon who will visit them.

III.

When on board the ship, they are to appear in uniform, consisting of a blue cloth cap with ribbon, dark blue cloth or dark serge trowsers, and a dark blue Guernsey or dark blue serge frock or jumper.

IV.

Caps are always to be touched on entering and leaving the ship, and on meeting or passing an Officer.

V.

Muster on board at 9 A.M. and at 1.10 P.M.; no smoking to take place on board the ship.

VI.

In case of fire in the vicinity of the docks, or on board of ships in the docks, the men are to muster on board the ship, going in parties to assist, as may be wanted.

The man then goes before the surgeon to see if he is fit for drill, free from hurt or infectious diseases. On two occasions, men were sent away from fear of infection. Should a man be unwell, he is told to appear again in a certain number of days; if necessary, this is entered in his book, but should the man have a hurt or disease of a permanent character, a written application is made for his discharge from the Force.

Having been permitted to drill by the surgeon, the man's book is examined to see if it is the right time for him to drill; arrears may be made up, but he cannot perform a fresh drill before a certain date, for instance, a man enrolled on the 1st January, 1874, performs 28 days' drill in 1874, but cannot commence another 28 days until the 1st January, 1875, unless it is necessary for him to go to sea, when he may be permitted to commence one month before that date; it being found the man comes within the regulations, he commences his drill.

Drill goes on every day throughout the year, except the regular holydays of the Queen's Birthday, Christmas Day, and Good Friday. On Sundays there is no drill, but the Reserve man gets pay for the day. Saturday afternoon is for cleaning ship, but there is permission to commence the cleaning as soon as the drill is over in the forenoon, going on through the dinner-hour, leaving for the day when finished; therefore, although paid for a week, the Reserve man has only been drilled 5½ days out of the 7, 11 days out of 14, 16½ days out of 21, and 22 days out of 28. This is laid down and is an important point, as when from sickness, leave, or absence two Saturdays and two Sundays come within a week's drill, care must be taken that one Sunday and one Saturday only count for pay, the other Sunday going for nothing, and the second Saturday as a half-day.

The drill-register is the book in which each day's drill is marked, and in certain cases might stand thus:—

9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
×	×	×	×	×	/	*red* ×	×	*red* 0	0	0	0	/	*red* ×	×	×	s	s	s	/	*red* ×	×	/

The crosses stand for whole days, the half crosses for half-days and Saturdays, the red crosses for Sundays, the red nought for leave, the black noughts for absence without leave, and S for sick. The first week, you will see, is correct; the man entered on Monday, the 9th, performing one week's drill. Five whole crosses, one half, and one red were placed against his name, the second has two Sundays and Saturdays, three days' sick, one day on leave, and three days absent without leave; but before a whole week's drill for payment is completed, there must be, in the whole, five crosses, one half-cross, and one red cross. Neither pay nor time is allowed men for ordinary sickness, but medicine and medical attendance; if a man is hurt on drill, or sick from causes connected with drill which he could not prevent, he receives his daily pay and medical attendance, but for no sickness is time allowed, that

IRREGULAR

PAGINATION

is to say, as soon as a man is well, he has to complete his arrears of drill. In 1871, of 784 that came on drill, 40 men were placed on the sick list, about the rate of 5 per cent.; of these, one was sent to hospital, and one was sick for pay 57 days, having fractured a toe when at the battery firing. In 1872, of 1,081 that came on drill, 101 were placed on the sick list, about 9·3 per cent.; one of these was sick for pay 82 days, having lost a toe-nail from a bruise at drill. In 1873, of 1,011 that came on drill, 82 were placed on the sick list, about 8·1 per cent.; one was sick for pay 98 days from the fracture of right hand when at drill. In 1874, of 398 that came on drill, 21 were placed on the sick list, about 5·2 per cent.; of these, one was sent to hospital. This gives about 7 per cent. sick always.

The drill-ships are placed in the neighbourhood of the greatest number of men; those who live away from those places—and Reserve men may be found at all seaports, both large and small—must travel to the nearest place of drill, whether it be a 1st Reserve ship, drill-ship, or coast-guard station; they are allowed their travelling expenses to and fro, being ordered to select the early cheap trains. These expenses are granted in the shape of railway passes given for every period of drill a man may take, provided there is a break at sea between the periods; that is to say, a man drilling for seven days will be paid going to drill from his home and returning home after drill, the Registrar gives the pass or cash in the first place, and the naval Officer the railway pass or cash on the completion of the drill, both being entered in the book, so that, seeing the entry by the Board of Trade authority, enables the Admiralty authority to know from whence the man came, and that he is authorised to give the man means to reach his home. No allowances are made to a man who wishes to go to any place for his own convenience, or who, at the end of a week's drill, chooses to go home for a day or so, or who may elect to travel daily to drill; only one pass at the beginning and one at the end, even if the drill lasts six weeks or two months. Some men live so far from any place of drill, that it would be impossible for them to arrive in time for the daily commencement, at 9 A.M. Rules are also laid down as to the time the men may take for travelling. First of all, the man is bound to be at the drill-ship or place by 9 A.M., if he can do so, leaving his home that morning at 5 or 6 A.M., however far his home may be. Should this not be possible, he must come as soon as he can, the maximum time allowed, if a man has to travel over 25 miles and drills for 14 days or more, is half-a-day at the commencement, he is also allowed half-a-day at the termination, but this is seldom necessary: leaving the drill-ship at 4 P.M., a man must live in a very out-of-the-way place if he cannot reach home that night some time before midnight; however, there are such cases for which this provides. Should the man, drill only for seven days, he is allowed one-fourth of a day at the commencement and one-fourth of a day at the termination, or he may take the half-day at the beginning or end.

The 1st Class Reserve man must appear in blue, with his uniform cap, which is given him on enrolment and each time he re-enrols; his blue clothes must be sailors' blue clothing. Of course this gave variety

in the appearance of the men; but it is so great an advance on what they were, dressed in every conceivable colour and cut of garment, that although much has to be done, yet the ice having been broken, the future, as regards the dress of the men, will I think be easy. I may here point out the 1st Class Naval Reserve is the only force under the Crown without a distinctive uniform; their dress is getting more alike each month, but they still want sadly a distinctive dress. The dress of the 1st Class Reserve now comprises serge frocks, jumpers, and guernseys, blue trowsers of cloth and serge, and in some cases men will try to be allowed to drill in a sort of monkey jacket of serge. Braces of course are worn, but not allowed to be seen over all; waistcoats also must be worn underneath. It is a little difficult to get over this dress matter, from there having been no dress at first, but I think now it is in a fair way of being settled.

The 2nd Class Reserve being given each year a suit of men-of-war's men's uniform as a part of the retainer, must wear it on drill, and after the first drill must present themselves for drill dressed in uniform. Having a distinctive dress, their appearance is admirable.

Having now brought the Reserve man to the drill-ship, we will leave him as one of the number on drill, and I will ask you to follow me through the drill-ship. About 9 A.M. the men are all walking about outside on the jetty, the bell strikes two, and they come on board. Jackets are taken off and hung up in the dress house, and they fall into their divisions, the classes making the divisions. These classes are composed of men in the week's drill for the year, 1st week's, 2nd week's, 3rd week's, and 4th week's men. The Instructors see their men present and decently dressed. On Thursdays I inspected the men, choosing that day from the old associations attached to rope-yarn Sunday. It was a trial to the men, as I made on principle, all the objectionable remarks I could as to holes in garments, dirty boots or caps, and general untidiness. Any bad clothes I ordered to be replaced, in one or two cases where they were very bad, stopping drill until replaced; at the same time doing exactly what I have been accustomed to do to man-of-war's men and no more, never asking a question to let in the thin end of the wedge of the man speaking to me; if necessary to question, seeing the man afterwards.

Twice a month muster took place, the Reserve man saying his rating in the last ship, period of enrolment, and whether a trained man. I made him say something going round that he might be accustomed to his own voice. At first he was very confidential, would come close and whisper that he was a pilot, harpooner, or A.B. in his second five years, but after a time he went round the capstan, especially the younger men, with the *aplomb* of a man-of-war's man. I regularly read the returns of courts-martial and articles of war, especially the clauses at the end relating to "in or belonging to," and "ordered to "be borne," the men listening with apparent interest.

These are very small details, but I give them here as having been done with a purpose, and that purpose, to initiate the Reserve men into the ways of the Navy, to make him as much a man-of-war's man as possible, so to prevent him being awkward and miserable if ever called

out; for when an adult is *gauche* at forms and ceremonies he is very unhappy. I have a vivid recollection of the men entered in 1854 and 1859, who I am convinced, amongst other causes, deserted from being objects of merriment by their awkwardness in doing what comes so easy to those who have been in the service from boyhood.

Divisions being over, the bell tolls for prayers, and after prayers, the respective classes fall in for their drills. The classes were divided by the week's drill the men were in of their year, four classes, the day being divided into four parts, changes are made in what the men do forenoon and afternoon, there being a ten minutes' "stand easy" in each half of the day.

Routine of Weekly Drills.

Day of the week.	Number of week on drill.	Forenoon.		Afternoon.	
		9.15 to 10.30.	10.40 to 11.45.	1,15 to 2.30.	2.40 to 3.50.
Monday.	1 2 3 4	Gun. Rifle. Gun. Lever target.	Gun. Gun. Rifle. Lever target.	Gun. Sword. Gun. Aiming drill.	Sword. Gun. Sword. Shells, &c.
Tuesday.	1 2 3 4	Gun. Rifle. Gun. Firing.	Gun. Gun. Rifle. Firing.	Gun. Sword. Gun. Firing.	Rifle. Gun. Sword. Firing.
Wednesday	1 2 3 4	Gun. Rifle. Gun. Gun or Company.	Gun. Gun. Rifle. Gun or Company.	Gun. Sword. Gun. Rifle examination.	Sword. Gun. Sword. Rifle examination.
Thursday.	1 3 3 4	Gun. Rifle. Gun. Gun or Sword.	Gun. Gun. Rifle. Gun or Sword.	Gun. Sword. Gun. Sword exam.	Rifle. Gun. Sword. Shells, &c.
Friday.	1 2 3 4	General quarters.	Gun. Rifle. Gun. Magazines, &c.	Gun. Gun exam. Rifle. Examination.	Sword. Gun exam. Sword. Examination.
Saturday.	1 2 3 4	Gun exam. Rifle. Gun exam. Cleaning arms.	Gun exam. Sword. Gun exam. Cleaning arms.	Cleaning ship.	

The 1st week's men go to the truck gun all through the week, with the exception of the second part of each afternoon, when they go to

rifle and sword alternately, these latter by numbers in slow time, unless the class happens to be of men long in the force.

At the truck gun it always begins slowly and works up. And here I must notice the use I found of the truck gun. The very running across the deck from one side to the other did the men good in a naval point of view. Silence was imperative, No. 1 from the first having to use signs. This week's drill broke the men into silence and quickness.

The 2nd and 3rd weeks' men went to heavy gun and rifle each forenoon, and heavy gun and sword each afternoon alternately; while one was at the heavy gun, the other was at rifle or sword. In the 2nd week each man was taught his duty as each number for the different firings, slowly and carefully, but the third week was the rubbing up week, and all was in quick time. The same with the rifle and sword, carefully and slowly in the 2nd week, quicker in the 3rd week; a portion of the Hythe course for precision in firing; at sword, the best men at stick practices, one afternoon cutting lead, and a part of another, pointing at a figure on a board. On two days in this fortnight, a half hour was devoted to learning the detail from the small books issued to the men. In the 4th week, lever target had half a day; aiming drill, with a rifle a quarter of a day; and one day the men went to a battery to fire two rounds from a 32-pounder gun, ten rounds of rifle firing and five rounds of volley firing. The rest of the week was divided into fire, sword, company and shells, those who were backward in gun drill in the 3rd week, going to gun drill instead of company drill. Examinations in rifle, sword, and general questions came also in this week, with Saturday forenoon instruction in rifle cleaning.

On Friday morning there is general quarters, at which the guns' crews were made up by men from all the different classes, the 4th week's men taking ones and twos, the 3rd week's men threes and fours, &c.; the 2nd week's men sevens and eights, and so on. I always had the men started from the upper deck, the guns being previously secured, as it gave them a run to their guns, and on all possible occasions I had one gun's crew of man-of-war's men made up with good Reserve men, as a standard crew; the man-of-war's men being with but one exception generally trained men, they were very useful to compare with the Reserve, and I must record it, the Reserve men lost nothing by the comparison; as far as I could judge, there was not one pin to choose between them, some of the Reserve being better captains of the guns than some of the man-of-war's men; altogether they were quite on a par, though the man-of-war's men were changed three different times in the three years. The man-of-war's man in the run for quarters, taught the Reserve man many little dodges of getting down hatchways, &c., which the latter picked up aptly, and on the order being given "carry on," after "quarters for action," poured down all hatchways, large and small, in the most approved style.

One bell was the "still" bugle; no word was allowed to be said from first to last, and I had the satisfaction of being told by a now Flag Captain, how surprised he was to find the men drilling silently, expecting to have found them running the guns in and out, and singing, "Brandy Killed my Sister Ann."

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	2	Rifle.	Gun.	Sword.	Gun.
	3	Gun.	Rifle.	Gun.	Sword.
	4	Lever target.	Lever target.	Aiming drill.	Shells, &c.
Tuesday.	1	Gun.	Gun.	Gun.	Rifle.
	2	Rifle.	Gun.	Sword.	Gun.
	3	Gun.	Rifle.	Gun.	Sword.
	4	Firing.	Firing.	Firing.	Firing.
Wednesday	1	Gun.	Gun.	Gun.	Sword.
	2	Rifle.	Gun.	Sword.	Gun.
	3	Gun.	Rifle.	Gun.	Sword.
	4	Gun or Company.	Gun or Company.	Rifle examination.	Rifle examination.
Thursday.	1	Gun.	Gun.	Gun.	Rifle.
	3	Rifle.	Gun.	Sword.	Gun.
	3	Gun.	Rifle.	Gun.	Sword.
	4	Gun or Sword.	Gun or Sword.	Sword exam.	Shells, &c.
Friday.	1	General quarters.	Gun.	Gun.	Sword.
	2		Rifle.	Gun exam.	Gun exam.
	3		Gun.	Rifle.	Sword.
	4		Magazines, &c.	Examination.	Examination.
Saturday.	1	Gun exam.	Gun exam.	Cleaning ship.	
	2	Rifle.	Sword.		
	3	Gun exam.	Gun exam.		
	4	Cleaning arms.	Cleaning arms.		

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I consider that the silent system has one of the best naval effects on the Reserve man. I never had to enforce it by any punishment beyond actually only two or three cases, when the man who had spoken was fallen out, and had to stand apart for the rest of drill, and when the others stood easy, he stood on deck; but it is so different to the noise and shouting the man is accustomed to in his vocation, that it has a quieting effect on him, and more than all this, being now a recognised necessity in the Service, should be carried out in the drill as in any other ship.

At general quarters, drill was simply gone through; no boarders or fire quarters. On the first Friday in every month I had an inspection, falling all the men in for rifle and sword-drill, and in the winter, on Thursdays, marched the men out of the town for company and battalion drill, only a few of the simple movements were taught, but it made a change and a break in the routine, doing I hope some good: at all events, it accustomed the men to march together, and from their size, they looked a very fine, heavy, body of men.

On Saturday, at a quarter to 12, instead of falling in to go away, the Reserve men in their classes assisted in the cleaning of the ship, finishing about half-past one, when they left for the day.

ROYAL NAVAL RESERVE.

H.M.S._____.

Drill Certificate of_____

	Full Nos.		Nos. gained.
1st week's instruction.....	20	.....	
2nd week's instruction	30	.....	
3rd week's instruction	30	.....	
4th week's instruction	20	.....	
Gun firing—2 rounds.....	12	.....	
Rifle firing—10 rounds	40	.....	
Rifle drill.....	24	.....	
Sword drill	24	.....	
Total.....	200	.....	

Nos. requisite for Rating of Trained Man— } 150

_____ Commander.

Entry_____, 187 .

Discharge_____, 187 .

_____, 187 .

At the end of each week each class was examined, and numbers awarded. On the completion of the month a drill certificate filled in was given each man. All those men who had obtained 150 numbers were given a badge, a red anchor to be worn on the cap above the ribbon, and were rated trained man. This gave them while wearing the badge one penny a day extra, and a very great boon besides, for a trained man who had entered for seven days' drill—the least number of days he could come for drill—and was suddenly wanted by some ship-

owner or master, or who found it was to his advantage to go to sea in a certain ship, could ask to be discharged, and his case being proved, is allowed to go, receiving pay and time for the number of days actually drilled; whereas a man who had not received the badge, and wished to go to sea under similar circumstances, must lose the part of the week drilled, having his book returned to him, getting no pay or time for the two or three days on board, and having to re-drill the same number of days again, or else lose the ship to finish the week's drill.

The advantages following on the rating of trained men is of the greatest value to the good men, the men who would be the leading men if serving in the Fleet. They are men who have paid attention to their drills, and the very fact of being wanted by some particular captain of a merchant ship, shows they are as well decent, steady, well behaved, good seamen.

Since the introduction of payment for the badge of trained man, and the other advantages, the badge has been much prized, and men try to gain it; it is ordered they shall come up to the standard for trained men in the Royal Navy, and I found them quite up to that standard. In 1871, 87 men were rated; in 1872, 162 more ratings were made; in 1873, 88 more; and 1874, 22 more. I am unable, I find, to give you the percentage, as, though I know the numbers drilled in each year, I do not know how many were on board who had been rated before, nor how many out of this number were re-awarded. A man to get three-fourths of full numbers, must be able to take any number at a gun, and have a good knowledge of rifle and sword drill; besides this, he must gain some numbers, both at gun and rifle firing. The want of numbers at rifle firing lost most men, who had paid attention during the month, their badge; but the numbers allowed for the 10 rounds are so many, a very good shot, of which there were but few, by ordinary attention was sure of his badge. The rifle firing of such of the Reserve as came before me is not good, but as the Hythe course is the only real rifle firing instruction, it is not to be wondered at these men getting practically none of it. On the gun-firing, but little reliance can be placed, as it took place from 32-pounders, with reduced charges at a range of 1,000 yards, and beyond seeing a gun let off, I consider it almost without value. The trained men, on returning to the drill-ship, are allowed seven days, and if at the end of seven days they are up to a certain mark, the badge is retained with all its advantages. The men were examined at the end of the week, and given numbers which I first placed at 80, but raised to 110; failing to obtain such numbers, the badge was lost. In 1871, 28 trained men returned to the ship; of these, 14 retained their badges, and 14 lost them, at the rate of 50 per cent. In 1872, 130 trained men returned to the ship; of these, 122 retained their badges, and 8 lost them, at the rate of 6·1 per cent. In 1873, 317 trained men returned to the ship; of these 284 retained their badges, and 33 lost them, at the rate of 10·4 per cent. In 1874, 128 trained men returned to the ship; of these, 121 retained their badges, and 7 lost them, at the rate of 5·4 per cent.

These figures relating to the trained men speak for themselves, and as at inspections, when the trained men were exercised separately, none

of them were found fault with, I am satisfied the system of numbers gave a standard of fact, a standard also to which men by paying attention might reach, and prevented men being given the badge from an opinion of their merits, either on my part or on the Instructor's.

The following is the summary of the drills, and manner of dividing the month in each year:—

Drill, &c.	1st week.	2nd week.	3rd week.	4th week.	Total.
Gun.....	4¼	2¾	3	1¼	11¼
Rifle	¼	1¼	1¼	1	4¼
Sword.....	¾	1¼	1¼	1	4¼
Firing.....	—	—	—	1¾	1¾
Cleaning arms	—	—	—	½	½
Saturday.....	½	½	½	½	2
Sunday	1	1	1	1	4
					28 days

The numbers on drill varied daily, as men were entered and discharged each day. On Monday and Tuesday most men joined, and on Saturday and Monday most were discharged. In 1872, the days received men as follows:—

Mondays..	728
Tuesdays	154
Wednesdays	96
Thursdays	78
Fridays	25
Saturdays	0
	1081

It will be seen about 81·6 per cent. joined on Monday and Tuesday, and for this reason practically Monday did well for the commencement of the classes that had to be examined at the end of the week; a fresh class could not be assembled for each set of men each day, so the rule was for the benefit of the many, the few about 18·4 per cent. had to take their chance at the examinations. In 1873 it was nearly the same:—

Mondays	675
Tuesdays	140
Wednesdays	89
Thursdays	60
Fridays	44
Saturdays	3
	1011

Giving about 80·6 per cent. for the two first days, and about 19·3 per cent. for the remainder.

The number of men on drill varied summer and winter. The average attendance daily was as follows:—

Summer of 1871	39 a day
Winter of 1871-2	73 „
Summer of 1872	35 „
Winter of 1872-3	75 „
Summer of 1873	27 „
Winter of 1873-4	74 „

The least number ever on drill was in the summer of 1873, 17, and the most in the winter of 1872, 150. The periods for which the men drill is another matter. I find in 1872, 411 drilled for 28 days at once, about 38 per cent. of the number on drill that year; and in 1873, 387 drilled also for a whole 28 days at one time, giving the same rate, about 38 per cent. A man who has drilled for 28 days at one period is in the end better instructed and disciplined than one, we will say, who has done one week every three months; but although it is more satisfactory the men should drill the whole time at once, it is, after all, not a matter on which to pin one's faith.

The most important duty connected with the drill ship is, after all, in my opinion, the discipline of the Reserve. A man may know his drills thoroughly, be one of the best of the trained men, but unless he is disciplined as well, that knowledge is not of much use, and my endeavour through all was to discipline the men, bringing them as a part of the Royal Navy as nearly as I could to the present standard of a man-of-war.

In the drill-ship there are two bodies of men, one, the man-of-war's man of course under naval discipline, and the other, the Reserve man, who has been told he is under naval discipline, but from traditions in the force I think inclined to believe some latitude should be allowed him. Perhaps he tried to take advantage of me as a new comer, but so I think I found him. It seemed to me, first of all, it was bad to have two bodies of men in the same ship, theoretically governed in the same way, but with a different idea running through the treatment of each, which made a practical difference. Then it seemed to me that if the Reserve man should ever be called out for service in the Fleet, surely now was the time to treat him exactly as he would find himself treated if so called out—that it was the fairest and really kindest course you could pursue towards him. He then sees and knows exactly what he has to expect, and should he feel it impossible to bear, at the expiration of his five years' engagement, he need not re-enrol. A man who cannot put up with the customs and regulations of Her Majesty's Navy in these days, is much better out of the service than in it. It could not be wrong to treat the Reserve man as a man-of-war's man; if wrong or over severe, we are so to the men of the Navy proper, whose lives must be a burden to them, and the sooner we wiped all our regulations out and started afresh the better. But if, after all the advancements in these years, we are right in the treat-

ment of our own blue jackets, it must be right to treat the Reserve man in the same way. I therefore started with the principle of no difference between one set of men and the other; no comparing notes that one might do this or that, and the other not; therefore, to all minor details of treatment I made no difference between the men under my orders; what one was punished for, so was the other; that which was expected of one was expected of the other; in all, both were alike; instant and prompt obedience was required from both equally; civility and all outward marks of respect, quickness of movement, and cleanliness of person extracted from all; and my belief is, the drill ship should be after the strictest pattern of the service of the period, that if the men were called out they would be agreeably disappointed when serving in a ship of the Fleet. I took every opportunity of ruling that while on drill a man was actually in the Navy, that he was at my orders any part of the day or night, and that whatever he was told to do, however much disliked, must always be done with at least apparent contentment. I had no wish that matters should be what is called made easy, although the Instructors, on joining, were warned of the necessity in teaching adults of combining firmness with quietness of manner; that everything in the shape of an altercation with a man must be avoided, on the slightest trouble to fall the man out and refer the matter.

By the rules for the punishment of the Reserve, the Commander of a drill-ship may fine a man up to 9*s.* a week, or direct up to seven days' drill to be forfeited, and recommend the stoppage of one or more retainers. The fines and forfeiture of days' drill correspond to the various scales of Admiralty punishments below deprivation of a good conduct badge, and the stoppage of one or more retainers correspond to the loss of a badge and all punishments above it. The fines are very practical. A man fined two or three shillings, in a few days receives his pay, and, instead of 21*s.*, is only given 18*s.* or 19*s.*, as the case may be. It is brought closely and quickly home to him, and I think on the Reserve man may be looked as a capital pressure; it is in effect so much less a week to live on, and is therefore a punishment that is felt.

The loss of a retainer, 30*s.* or 12*s.* 6*d.*, according to the class, on the next quarter day, is a heavy punishment taking that sum off a man's yearly income. The rules I mentioned before, read to the Reserve man on coming on drill, were rigidly adhered to, and every man reported was entered, that I can give the accurate number of offences. I invariably fined a man 1*s.* a day for every day absent without leave. Of course the day had to be made good, putting his pay day one day farther on. If absent after a day's leave, I generally had a day's drill forfeited as well, so three days had to be made good—the leave, the absent, and the forfeited. For being drunk on board, or coming drunk for drill, fines from 2*s.* 6*d.* to 5*s.*, and sent on shore again immediately, the day having to be made good. Inattention at drill, from 1*s.* 6*d.* to 2*s.* 6*d.* Improper behaviour to an Instructor or Warrant Officer, from 2*s.* 6*d.* to 7*s.* A direct act of insubordination I always reported, with a request a retainer might be stopped. The

Warrant Officers and police were, most of the time, straightforward and correct, the Instructors quiet-mannered, painstaking men, and I believe all the Reserve men reported were fairly brought forward. I have reason to feel sure no man was screened, neither was any man oppressed.

In 1871, out of 784 Reserve men 61 were punished, at the rate of 7·7 per cent. In 1872, out of 1,081 Reserve men, 71 were punished, at the rate of 6·5 per cent. In 1873, out of 1,011 Reserve men, 54 were punished, at the rate of 5·3 per cent. In 1874, out of 398 Reserve men, 28 were punished, at the rate of 7 per cent. In these numbers every trivial offence is recorded, and the reprimands given to men in the first year of their service. The most of the offences were of one sort, breaking leave, which is the most troublesome of the offences. Leave was never withheld from a man if he asked for it, there being no reason to refuse leave. I said it was always to be given, even to two or three days; of course it had to be made good, but the man was away by right. To make the man ask leave was a point gained, and therefore whenever he stayed away without asking, I listened to no excuses of births, marriages, or deaths—the latter being invariably the one considered strong, but fined steadily. I do not think I made any ground, as the leave-breaking at last was the same as at first.

In 1871 there were 35 cases of leave-breaking, being 57 per cent. of the offences; they varied from half a-day to 13 days, the latter, with two others who were away 7 days, losing a retainer. In 1872 there were 51 cases of leave-breaking, being 71·9 per cent. of the offences, varying from 1 to 9 days. In 1873 there were 45 cases of leave-breaking, being 83 per cent. of the offences, varying from half a-day to 6 days. In 1874 there were 26 cases of leave-breaking, being 92·8 per cent. of the offences, varying from 1 to 5½ days. It will be seen by this that the leave-breaking, which increased each year, as regards the whole number of offences, decreased as to the maximum length of time absent in each year; there was more of it, but it was in each year of less duration than the year previous. Of the remainder of the offences in 1871, 6 were for drunkenness; 9 for inattention at drill; 1 leaving the ship without leave; 3 disrespect; and 7 minor offences. In 1872 there were 7 for drunkenness; 2 for inattention at drill; 1 leaving the ship without leave; 6 for disobedience of orders; 1 for insubordination; and 3 minor offences. In 1873 there were 2 for drunkenness; 1 inattention at drill; 2 disobedience of orders; 1 for insubordination; and 3 minor offences. In 1874 there was 1 for drunkenness, and 1 for insubordination. The above show that in the drill-ship I had nearly 7 per cent. of the men as defaulters all over the year; that leave-breaking became more frequent, but that drunkenness and inattention at drill decreased; the remainder keeping always about the same. I do not think the numbers of offenders were excessive; but I wish the leave-breaking had been less; of course the numbers cannot be compared with a ship of the Fleet, as there the men live and sleep on board, are on duty day and night, subject to all sorts of calls and various duties; with each duty it may be a different master. I contend, however, for the Reserve men that

the numbers show they are well behaved as a body, and that Officers are entitled to call their general conduct "Very good." I also contend that as drunkenness decreased, and there were so few offences of inattention, disrespect, and insubordination out of the numbers in the drill-ship for the years mentioned, they are in a measure prepared to accept naval discipline, and not to fight against it. This is to me one of the most hopeful features of the future, and causes me to believe, if called out for service with straightforward strict dealing, they will fall into man-of-war ways in a manner that will surprise everybody.

The Reserve man may seek employment where he likes provided he performs the drill required of him, and appears before a Registrar once in every six months, unless he has permission to stay away longer: therefore he can only ship for such voyages as will not last six months. Should, however, he wish to go foreign on a long voyage, he must apply to the Registrar for leave, being the person alone who can grant it, and having shown he has performed 28 days' drill if in his first period of enrolment, and after that, 14 days' drill for the year, and there being no orders to withhold the leave—a power the Government reserve to themselves—it is granted him, and he leaves England in a certain ship on a certain voyage, the Registrar placing in his book "with leave." Should the Royal Proclamation call the Force out, the man is bound to serve in any of Her Majesty's ships on a foreign station, one retainer may be advanced before leaving; arrears of retainers to be paid on return.

The Reserve men must forward all changes of residence to the Registrar, who always knows the ship a man is in; and such care is taken that the Registrar-General of Seamen from the returns sent him, knows exactly where all the men are, and if wanted—I believe I am not saying too much—every man's whereabouts is so well known that he could be got at individually.

Certain penalties follow on the breaking of the regulations—a man losing a retainer if he is away longer than the time granted, leaves the ship allowed to sail in, or deserts; these punishments are inflicted by the Registrar-General.

Should the Reserve be called out for service in the Navy, these men can only be kept for five years in the whole; three years in the first place, then two years, receiving for these last two, an additional 2*d.* a-day; but at the end of the five years, a man can claim his discharge, unless he shall have re-enrolled in the Reserve.

A Reserve man failing to appear when called out, can be treated as a straggler or deserter from the Fleet.

If a man is serving abroad, he may either be taken out of his ship by a naval Officer, taking care to distress the merchant ship as little as possible, or he must serve on arrival in the United Kingdom. If a man should behave very badly while called out, in addition to the punishments he may receive at the time, he may be struck off the list of the Reserve, which prevents him getting the pension or any retainers that may be due to him.

When a Reserve man has completed his period of enrolment (five

years), he is entitled to his discharge, provided he is not required for service in the Navy; he may also during the five years, purchase his discharge for £10, or by refunding the retainers when less than that sum; should a man obtain a certificate of competency, and employment as mate or master, he can, if he wishes, obtain his discharge from the Force, provided it is not called out. A Reserve man may be discharged for physical inability and for various misdeeds, such as neglect to serve in the Navy if required, attend drill, or report himself to the Registrar; desertion, making false statements and representations; serving in a false name; going on a long voyage without leave; entering the service of a foreign country; and for conviction in a court of justice.

Having completed five years' service in the Reserve, a man may re-enrol for a further period of five years; the sea service required of him for this and future engagements may be as pilot, regular employment in tugs, ferries, or other boats, and in fitting or re-fitting ships. For the first five years a man must have been at sea, and passed an A.B.'s examination; but after being once passed, it is not required of him again, and he may have the employment mentioned above. As a rule, I think it is the steadiest men who take such employment, and therefore, although not actually going to sea, they are enough in connection with it to be worth keeping.

The men for re-enrolment are medically examined as before, and also examined in Gunnery, &c., to see they have made a fair progress. In 1871, 133 men presented themselves for re-enrolment; of these 2 were rejected as medically unfit; 1 by the Registrar-General; 1 left his papers and never re-appeared.

In 1872, 138 men came to re-enrol; 8 were medically unfit; 2 left their papers and never re-appeared. In 1873, 102 men came to re-enrol; 1 was medically unfit; 2 again left their papers and never re-appeared. In 1874, 20 men came and were enrolled; none were rejected for want of progress in gunnery.

If a man is in the United Kingdom, and allows three months to elapse without seeking to be enrolled, he is considered to have voluntarily quitted the Reserve, and loses claim to all benefits he may have earned by being in it. 2nd Class Reserve men may be promoted to 1st Class, provided they are of good character, under 30, been two years a 2nd Class man, served 12 months as A.B. in a merchant ship, can pass the A.B. examination, and have made satisfactory progress in gunnery. No 2nd Class Reserve man is entitled to a pension from the Reserve; should he become a 1st Class man, half his 2nd Class time is allowed to count.

The 1st Class Reserve man obtains a pension of £12 a year at the age of 60, or before that, if incapacitated from earning his own living by causes he could not prevent, provided he has served 20 years if he entered under 30, and above that age 15 years, time in the Royal Navy, if called out, counting double. Of course a man wounded or hurt on drill, or when called out, is treated in all respects as a man-of-war's man. Reserve men by service in the Navy may have a naval pension and Reserve pension, provided the aggregate does not exceed the

largest naval pension, and he may also, if married, share his pension with his wife, having it reduced in his lifetime, that she may have the same continued to her at his death; all pensioners must be paid in the United Kingdom, and only abroad by special permission.

A trained man who has been 10 years in the Reserve, and is under 37 years of age, may be appointed to the Coast Guard, where he can remain until he is 50, being in all respects a Coast Guardsman; when discharged at 50, he obtains the £12 a year pension. These Reserve appointments to the Coast Guard are not to exceed 5 per cent. of the vacancies for the year.

Everything in the regulations is, in my opinion, in the interests of the men; he can drill when he likes; he can go where he likes; he gets drill pay and retainers for time, which must otherwise be spent kicking about the docks waiting for a ship. It is easy for him to enrol and re-enrol. Remaining in the force, he gets £12 a year at the age of 60, as a pension, and in return for this, he is a month a year in a man-of-war, drilling as a rule from 9 till 12, and from 1 to 4 daily; must report himself every six months to a Registrar, and in certain cases ask permission to go for a certain voyage, and has the prospect during the five years' engagement of being obliged to serve his country for five years at sea in the Fleet, at a time when every sailor man will be of use in that Fleet, and when it would be a shame for any sailor man, Reserve or otherwise, to hold back from the war service going on. I cannot help thinking the advantages the Reserve men have over other merchant seamen should keep the numbers up. The difference in earnings between one in the Reserve and one out of it in five years is £51, and the £51 is earned in spare time. Between 300 and 400 men have joined within the last six weeks. I hope most of them are as young as the regulations will allow, and that the 2nd Class Reserve will gain strength. I visited the east of Fife last year, and there saw a body of young fishermen who have been accustomed to the sea from their cradles, and who, if obtained for the Reserve, will be worth much; fine, strapping fellows, strong, and hard as nails, whose nerves have been tried on many a wild night, when at the fishing off the east coast.

I have questioned captains of merchant ships and others as to their opinion of the Reserve men, comparing them with other merchant seamen, and have received various answers. Some said there was no difference between the Reserve and other seamen; others that the Reserve men were more inclined to be sea-lawyers; and others again, that the best of their men were always Reserve men. One captain of a whaler, who invariably shipped the same men year after year, preferred the Reserve men, believing the drill improved them mentally, making them sharper and quicker, enabling them to work better together, and as a matter of discipline, they took orders at once from men immediately over them; and the owner of a whaler told me he was sure he benefited by the discipline taught the men in the drill-ship, as they learnt to do as they were told, without questioning the order—of some consequence in a whaler, where so much depends on the men in charge of the boats. Taking it all round, my own impression is, the Reserve men are the best men as a rule of the Mercantile Marine; that

the drill-ship does develop quickness and obedience, and that the Reserve man bears the same relation to other merchant seamen as the seaman gunner does to other man-of-war's men. Believing this, I think all who are connected with the seafaring population of this country should try and induce men to join the force; naval Officers, because Reserves for the Navy are so wanted; merchant captains, because the drill-ship in a measure teaches obedience; and owners, because they can man their ships with an improved man. I would also that some use might be made of all boys who go to sea, or who do not go to sea, from the industrial school ships, to which ships the Government pays a yearly grant; and for that reason the country, I think, should have a return in the boys' service in the 1st or 2nd Class Reserves, or Militia, until they reach the age of 28; those who go to sea for the Naval Reserves, 2nd Class, first, and afterwards, when able, the 1st Class, those who go on shore for the Militia. These boys leave the school ships, having been disciplined, which discipline the drill-ship would yearly renew; and I venture to say the addition to the Reserves of the country would be yearly more valuable.

The Registrar-General has kindly given me the following numbers relating to the Reserve:—

Since the force was first started have applied to be enrolled, on 31st March last		39,321
Accepted 1st class.....	31,419	
„ 2nd class	2,366	
Of this number—		33,785
Discharged.....	2,997	
Died	3,445	
Joined the Royal Navy	684	
Not applied to be enrolled	12,704	
Promoted from 2nd to 1st class	9	
		19,839
Leaving on the 31st March.....		13,946

Of these men there were—	
Estimated in country, trade, and at home.....	8,342
Expected home within 1 month.....	2,845
„ „ „ 2 months	502
„ „ „ 3 „	708
„ „ „ 4 „	297
„ „ „ 6 „	375
„ „ „ 12 „	426

By this it may be seen, that over 8,000 men, the Registrar-General could place in the naval depôts within a very few days. The average age of the 1st Class men is 30 years 5 months; of the 2nd Class men, 24 years.

On the 30th April, the force had increased to 14,201, viz., 11,739 in the 1st Class, and 2,462 in the 2nd Class; and on the 13th May (last Wednesday, there were 14,235, viz., 11,711 1st Class, and 2,524 2nd

Class men, showing an increase in six weeks of 289 men, 102 1st Class, and 187 2nd Class.

Having now placed before you all the information I have been able to collect in connection with the Reserve, the summing up appears to me—

1st. The 1st Class Reserve man is a *bonâ fide* able seaman.

2nd. The 2nd Class Reserve man is a good ordinary seaman, thoroughly accustomed to the sea.

3rd. The *physique* of the men is exceptionally good, of those I saw: an average of 5 feet 6 inches of height, 10 stone 8 lbs. of weight, and $35\frac{1}{5}$ inches of chest measurement.

4th. The men pay attention to their drills, becoming as a rule efficient.

5th. That their conduct is good on the whole, the leave-breaking giving the greatest trouble, and that, as far as was required of them in the drill-ship, they adopted without trouble man-of-war ways.

Of course, this only relates to such men as I saw; in other drill-ships, the men were perhaps better behaved and more attentive, in some not so good. The men that came before me were principally the crews of whalers—I should think half of them—the other half serving in coasting-ships and East Indiamen, with a few that were in no particular line.

I would that the Reserve man knew more of the Royal Navy, and that both Officers and men of the Royal Navy had more to do with him. I wish to see a closer connection between the two, a connection made by acquaintance, which is far better than any lecture. For this reason I should like to see an Admiral in command of the Reserves with a regular Staff; not a retired Admiral, but one on the active list who has just been in command of a squadron, with his Staff and flag in one of the drill-ships, and having a tender, that he might move about the coasts. I should also like to see Captains for the Reserve districts, and in the drill-ships, besides the Commander, a Lieutenant; none of the Officers to stay too long, except the civilians, who, as at present, should be seniors; the same routine of drill carried out in each drill-ship, and emanating from the Admiral; all drill-ships alike, and as the Officers come from seagoing ships, like all ships in the service afloat, the same regulations and discipline; a perfectly strict naval discipline through all; a distinctive dress for the 1st Class men. This is so much needed, that I must press it for a moment. The 2nd Class men are dressed as man-of-war's men, and right well they look, and the 1st Class man should be dressed the same; but the money to pay for his clothes should come out of his retainer, and not his drill pay. He comes on drill as a means of gaining a livelihood, and a few shillings out of the guinea is of vital consequence, whereas out of the retainer he would not feel it so much. The order for a dress, however, should only be compulsory on all men entering, or when making a fresh engagement.

As an increased means to the usefulness of the Reserves, I advocate that to each drill-ship should be attached a gunboat of the "Staunch" class, that the men may fire at sea one of the very guns they would be called on to use if ever in action, and then prize-firing might be allowed both for heavy gun and rifle.

Could it be done, it would have a beneficial effect on the drill-ships, if once a year, or even once in two or three years, the drill-ships should send a team of men to the "Excellent;" there all to be examined together by the "Excellent's" Officers, and an order of merit given; this would tend to keep the Instructors always on the alert. One time, the team might be composed of trained men, at another, of men in the first term, and so on, the time of year being selected when most men were on drill.

I want the Reserve to be thought of and felt as a part of the whole Service, and for that reason I advocate this close relationship between them and men on active service, that the Reserve man may know the place he may have to take in a man-of-war, the Officers and treatment before him. This, should he ever be called out, will keep him a contented man, and send him back to the merchant service at the end of his compulsory service, with such a story of naval life as will keep the Reserves filled up to their required extent, and enable the heaviest punishment to be "discharged as objectionable;" but imagine, on the other hand, the Reserve man drafted into the service with stories on the quarter and lower decks, of his want of discipline and love of license, all coming at the time of war, when perhaps the ship's company is made up from odd sources, and Officers are inclined not to be over particular in what they do, provided the end is reached, the good fighting condition of their ship, I venture to say a reign of over smartness would be inaugurated, junior Officers of all classes, both subordinate and petty, would take the cue. "No Reserve tricks now!" "No merchant ship dodges "here!" would be familiar cries, ending in a reign of terrorism, which would send the Reserve man away at this time in the century with stronger feelings of hatred and dislike to the Royal Navy than his forefathers had at the close of the last war, and which for another generation would leave the ranks of the Reserve empty.

I hope a close connection with the Royal Navy will steadily grow, and that every one will know of it. I for one am convinced it is for the benefit of the country, for, as time goes on, my belief is the numbers of the Reserve would increase instead of diminish, and as no one yet knows—for all jib the question—what number we should want in the Royal Navy in time of war, therefore I would that the Reserves were twice, even three times their present strength. A large maritime war means for England war in every corner of the globe, ships of all sorts to be manned at once, and then it is not finished; relays of men to fill up the gaps, and relays again and again until peace is declared; it means also that the power of gaining a livelihood for most of the seafaring population of these islands is for the time stopped, except by service in the Royal Navy—and to the Royal Navy, whether they like it or not, they must come to live. Surely in such a case every drilled and partially disciplined man is worth a great deal, therefore in my opinion, too much care cannot be taken to instruct those who volunteer for the Reserves in time of peace.

It may be gathered from this paper that I think well of the Royal Naval Reserve man, such as I found him. I do, exceedingly well; he

is not like a man-of-war's man; their lives have been so different; the one having been cared for from his youth, while the other has had but hard, rough work, and I fear often hard usage. But seeing what I have of him, I would in time of war gladly command a ship manned by Reserve men, with but a few man-of-war petty Officers; and, to use an expression familiar enough to many of my hearers, they could be made to "tear a ship to pieces in no time."

Captain GARDNER, R.N.: I would wish, Sir, to express my satisfaction at hearing Captain Brent give such a favourable account of the Royal Naval Reserve, only confirming what the *old* friends of the Reserve always believed it would become, viz., an efficient force. I should like to ask him one or two questions; in the first place whether the armament of the drill-ship at Dundee was changed during the time he commanded her; secondly, whether a gun-boat was attached to her; and, after his experience of drilling these men at the old gun exercise, how long a time he would consider necessary to bring a Reserve man to a sufficient knowledge of the drill for the new guns so as to make him fit to fall into his place at the gun? and lastly—if he was at Dundee when the new regulations came out—can he say what effect they had on the seafaring population on the east coast of Scotland in inducing them to join the 2nd Class Reserve?

Commander W. DAWSON, R.N.: Sir, the very highly satisfactory account we have received from Captain Brent after his three years' experience of the Royal Naval Reserve will, I hope, go forth through the length and breadth of the country. The country is to be congratulated on the fact that, at any rate in this portion of the Naval force, we have not got merely men on paper and a phantom reserve, and it is very satisfactory to me to find that in a distant part of the kingdom like Dundee, Captain Brent found the Reserve in very much the same high state of efficiency as I had myself observed with reference to that portion of the force which drills in London. Some four or five years ago before I was compulsorily made a retired Officer, and when I was supposed to know something of these things, I had the honour of going on board the "President" in the City Canal, and seeing the men under drill, and my own impressions of their warlike efficiency were very much the same as Captain Brent has conveyed to us with reference to the Reserve men in Scotland. I therefore suppose we may assume that the great majority of the Reserve are very much of that seamanlike and warlike character. But the mischief is that an "intelligent foreigner" might say of our Reserve, as one is reported to have said of the British infantry, "fortunately for "their foes there are very few of them." When we look at that table, and see that there are only 14,000 Reserve men altogether, out of 202,000 men employed in the Mercantile Marine last year, I do not think that that is at all satisfactory, especially when we remember that 30,000 men was the number sanctioned by Parliament many years ago to be enrolled, and that at one time the force in the Reserve did, I believe, amount to 16,000 or 17,000 men. Last year, if my memory serves me right, it fell to somewhere about 11,000 men. That appears to me to show that there are some things still wanting in the Reserve; and I question whether we are not aiming at rather too high a standard in the class of men we are trying to enlist. Seeing that we cannot obtain 30,000 fully qualified and superior seamen, might it not be better to lower our standard of seamanship, and thus bring in a larger number of those sea-going men who are now being excluded? For, after all, what does the Royal Navy want in a maritime war? We want, if we could get them, persons who are the most highly skilled seamen, the best drilled artillerymen, and the most disciplined force, in short, additional man-of-war's men. But these cannot be improvised, and after all, every man in a ship of war need not be a skilled seaman. It is most unfair in my estimation, and most unreasonable, to compare Reserve seamen who have been brought up in the Mercantile Marine all their lives, and who have only given 28 days in the year for a few years to gun drill, with the men whose whole training from boyhood has been one unbroken life of preparation for war. It is just as unreasonable as to compare a volunteer regiment with a regi-

ment of the Line; and that is the fault into which it appears to me Naval Officers will be very liable to fall, if they are promiscuously placed in commands over the Naval Reserve. Officers selected for the Reserve should be men of peculiar judgment and special adaptibility for dealing with persons who are civilians brought for a short time under naval discipline, but as yet not subject to the Naval Discipline Act. I do not at all conjure up to my mind any great difficulty in the event of war, from the circumstance that these men have not experienced the stern realities of life in ships of war. I suppose when the Naval Reserve men are called out in time of war that naval Officers would be found capable of maintaining discipline. For, unless the Active Lists had been by some new-fangled retirement-scheme swept of all decent and capable Officers, I hope that they would be able to keep order and command efficiently the men of the Naval Reserve as at present disciplined. Looking at the efficiency already attained, and looking at that table of drill before me, I confess that there seems great room for improvement in the system of instruction. As an old Drill Instructor, I know a good deal of the merits and demerits of drill, and I would teach more by one day's shooting with powder and shot than by ten day's dry motions. I would also teach more by putting into a seaman's hand for one day the implement which he is likely to use, than by giving him ten days' drill with an obsolete weapon which he is never likely to use in actual service. Those are two points on which I think the system of instruction is susceptible of great improvement. When we turn to the question of numbers, and find that these lately fell very considerably, a question arises as to the naval part of the government of the Reserve. Whose fault was this large decrease? Why did some 12,000 seamen decline to renew their engagements after five years' experience and instruction? Was this the fault of the Navy or of the Registrar-General of Seamen? Why are the numbers even now in the Reserve so small? What we may reasonably look for in a Reserve formed out of the Mercantile Marine, and what we should be glad to obtain in time of war are sea-artillerymen, having sea-legs and sea-stomachs, men capable of pulling an oar and steering a ship, and willing to do what they are told. As to the rest of a regular man-of-war's man's qualifications, we must be content to give them up if they are not obtainable. That is to say, it is a secondary matter whether a disciplined sea-artilleryman can make all the knots and splices or not, or whether he can do all the minutiæ of sea-work which is done by the *bonâ fide* man-of-war's man. If we cannot have these extra qualifications we must be prepared to resign them in order to obtain large numbers of disciplined sea-artillerymen and seamen. For my own part, I think that we ought not to be satisfied with a Reserve from the merchant service of less than 30,000 or 40,000, or even 50,000 trained men; and considering that we have 202,000 men in the shipping trade of this country, I think that would not be an unreasonable proportion to ask for. But if you are going to ask for them all to be qualified seamen in the naval sense of that term, I think you will be very liable to disappointment. When we remember that out of about 85,000 men who are employed in the foreign trade of this country, 16,000 are foreigners, that is to say, 22 or 23 per cent., and that a large proportion of these foreigners are north country sailors, and are in my judgment better seamen than the Englishmen with whom they are associated—that they monopolise in fact to a great extent the prime seamen of the Mercantile Marine, I do not think you can expect to find a very large proportion of Englishmen who are prime seamen, in addition to those excellent seamen who are at present in the Reserve Force. Therefore I think it will become necessary, if the force is to be increased in number, for us to moderate our desires, and to be content with less seamanship, and a fair proportion of gunnery and discipline. The two essential points that we cannot dispense with besides mere sea stomachs and sea legs, are obedience to orders and gunnery drills. We must not shut our eyes to the circumstance that the Naval Reserve is for some reason or other not very popular in the Mercantile Navy; the men who join the Reserve may be content, though as about 12,000 of them have not renewed their engagements, that fact is not fully established; but the persons who do not come to the Reserve evidently do not like the terms. Therefore it would be better to look into the terms not from our point of view, but from the point of view of the merchant seaman. He has his price, and we have evidently not made the proper bid as yet.

I wish to add that the organisation of our small Naval Reserve is as complete as its members are efficient. Arrangements are perfected for calling out by telegraph, on the sudden outbreak or probable outbreak of a maritime war, the whole of the Reserve men in the United Kingdom. Letters containing the requisite instructions to each of the Marine Superintendents and Collectors of Customs, specifying the points of rendezvous, and the ports of embarkation, and every detail connected therewith as respects each particular locality, are already prepared and addressed, ready for posting, in the office of the Registrar-General of Seamen. Should the Registrar-General receive through "the usual channels of communication" an impression that a maritime war was probable, he would order these letters to be posted. The Board of Trade officials at the out-ports would thus have time to study and prepare to carry out their instructions, on receiving, what these letters tell them to await before taking action, telegrams with the word "proceed." Then when the Admiralty need the Reserve men, they would send to the Registrar-General of Seamen, who would take the printed list of Reserve stations over to the Central Telegraph Office, and ask Mr. Scudamore to telegraph the word "proceed" to each. The Admiralty would meanwhile telegraph to the district ships to send gunboats to various points to receive the Reserve men so collected, and to convey them to their ships. This perfect state of readiness is worthy all commendation at home, and may prove a wholesome warning to doubtful friends abroad. It is estimated that by such a telegram some 8,000 prime merchant seamen, fair artillerymen, can be added to the Navy in one day, and in the course of a month some 3,000 or 4,000 more, the remainder being picked up at home or on foreign stations within six months after the call.

I am extremely sorry to find that Admirals Osborn and Ryder are not here to night, as I was in hopes they would have enriched this discussion with their long and practical experience. Our Reserves are a matter to which they have devoted far more attention than I have, and they would have been able to speak not only with greater knowledge but also with greater authority than I can pretend to on such an important question.

Captain HOPKINS, R.N.: I think the gentleman who has just got up, so ably expressed the views of most of us with regard to the Reserve, that it leaves very little for me to say. But, as an outsider, who has served a great deal lately in Her Majesty's Navy, I must express my concurrence in his statement that what we require are men with stomachs and *physique*, and men who can steer a ship and pull an oar. I do not think we want men in the Navy who can sew a seam, or men who can knot and splice in time of war; we want those men certainly with good stomachs who can pull an oar and fight a gun. One point on which no one has spoken, is the question of a reserve of stokers. I think in future wars, one of the most essential points would be, to have a reserve of stokers, and if by any means some of the stokers of the mercantile marine could be attracted to our service in the same manner that blue-jackets are now, it would be very beneficial.

Captain GARDNER: I should like to ask Captain Brent one other question. Has he compared notes with the Commanders of other drill-ships?

Commander BRENT: The armament of the "Brilliant" was a 100-pounder smooth-bore on an old wooden slide carriage, but the ship at Aberdeen has a 6½-ton gun as well, with iron carriages of the newest pattern. When I left Dundee, the new drill-ship had a 6½-ton gun, and the 100-pounder from "Brilliant" was going to her, both guns on the very latest iron carriages.

Captain GARDNER: Do they fire?

Commander BRENT: No, they do not fire these guns. It is one of the things that we have been trying to get, that there should be attached to the drill-ships a gunboat of the "Staunch" class, to fire these heavy guns. As Captain Dawson remarked, it is much better to a certain degree that the men should fire than be drilled; but the expense is a matter of consideration. We tried, three years ago, to get a gunboat of the "Staunch" class attached. The fact of the matter is, there are not enough of them, and when there are more, you will find that each drill-ship will have one attached to it; that is my belief. Most of the drill was at heavy guns. The whole 11¼ days that you see in the "Routine of Drill," was not at truck gun, 7 days of it were at the heavy gun, using an 8-inch projectile, and 4¼ days were at a

truck gun. The second and third weeks the men were put to the heavy guns. I do not think you lose anything by using the truck gun; at least, I always found it did a great deal of good.

Captain GARDNER: May I ask whether you are conversant with the new gunnery?

Commander BRENT: Yes; nothing but the new gun drill is taught; the Instructors come out of the "Excellent" continuously. We are very often changing them, so that you get the very latest things, and you have a fresh gunner up from the "Excellent" every year, and he comes up, as Captain Dawson knows, quite full of everything that is new. There was no gun-boat attached to the drill-ship at Dundee. I do not know much of the other drill-ships. At Aberdeen I saw the very men Captain Hopkins has asked for, men who will not get sea-sick, accustomed to the sea, who can pull an oar; in fact, they were fishermen, not men who can knot and splice, but a grand set of fellows.

Captain GARDNER: Did you find your way to Peterhead?

Commander BRENT: No, I did not go there. I saw the men in the east of Fife; they were a fine set of men, just like the men at Aberdeen, whose great delight was to come on board at any time they could during the dinner-hour, get the single-sticks, and lather one another. Whether it would be right to extend the numbers of the 1st Class Reserve is an open question; but if you have 14,000 or 15,000 of them, depend upon it each one of those would be of use, and they would be as good seamen as you could get. You would want them if you come to a maritime war; you will want the men who do not get sea-sick, and you will want the good seamen too. Whether the 2nd Class Reserve men should be 30,000 and the others 15,000, is perhaps an open question. The effect of the new regulations is to bring 2nd Class Reserve men in, and, as I told you, 298 men in all, have been enrolled within the last six weeks. This shows that the numbers are increasing. These men are very funny—they are very much like a flock of sheep. If you take one fisherman from a place, the others will all come; but the difficulty is to get the one man—having him, the others will follow. Captain Dawson said just now he thought you would be able to get them into order in the time of war, and he must be a very poor Officer who could not get them into order then; but would it not be very much better if you had men who had been drilled and accustomed to obedience? You won't accustom them to obedience until you get them into the Reserves; and if you have men not accustomed to obedience, in time of war, Officers will be a little bit then on their own hook, and will do all sorts of things, and then these men will go back and you will find your Reserves will come to nothing. The thing is to get as many as you can, and to drill them exactly as they would be drilled in time of war. That is what I advocate so much.

Captain DAWSON: My remark applied rather to mixing naval Officers promiscuously with the Reserve.

Commander BRENT: I do not think you should quite say that. We all go through the same mill, and are supposed to be alike, as far as that goes, you must take your chance of Officers; but the more naval Officers see of the Reserve, the better for the Reserve men. I should like to see naval Officers become acquainted with them in every way. As to the time taken to fit the men, I had some—one or two—who became trained men in their first drill.

Captain GARDNER: My question was—I was going to mention my own experience afterwards—how long you would consider it necessary for those men who have been trained with the old gun to be instructed in the drill at the new gun?

Commander BRENT: I think if they had been drilled at the old gun, in a fortnight they would be fit for the new gun.

Captain GARDNER: That perfectly accords with my own experience.

Commander BRENT: The new gun drill is much easier than the old, and they learn it very quickly. In a fortnight you might teach them all the new things, even if they had only been drilled before at a truck gun at some of the Coast Guard batteries.

Captain GARDNER: How about the machinery of the carriages?

Commander BRENT: At machine carriages, I mean, with new compressors, winches, running-in-and-out chains, and everything, they might obtain a perfect knowledge of it in a fortnight with the greatest ease.

The CHAIRMAN: I am sorry we have not had a large audience to-night to listen to a very interesting and a very elaborate paper. I regret that, in this Institution, a subject which is not only of great interest, but of vital importance—the subject of Naval Reserves—should not have been more fully discussed. Captain Dawson has mentioned Admiral Sherard Osborn; I was in hopes that he, Admiral Ryder, and others, who have given great attention to this subject, would have been here this evening. With regard to the remark of Captain Dawson as to the small number of the Reserve, it is quite true that the numbers are very small if you compare them with those of our mercantile seamen; but I think that if we take the number of ships to be manned and see the number of pure seamen actually required, having already the Officers, marines, and others to fill up the complements of the ships—I think the numbers stated here form a very good Reserve. Captain Brent said 8,000 men could be found very speedily; now, if you distribute 8,000 men, pure seamen, you will find that they will go very far to man a very large number of ships, especially the ships of the present day; and although it is quite true that 14,000, the total of the Reserve, are but a very small proportion of all the seamen of the Mercantile Marine, I think the number, especially of men of the quality described by Captain Brent, form really a very good Reserve, added to the Marines on shore, who, of course, would be embarked, and the Coast-Guard men. We should all be only too happy to see the numbers of the Reserve increased to the 30,000 or 40,000, as suggested, provided you can get them; and, although I have heard something to-night about men who are merely accustomed to the sea, and have, as somebody said, sea stomachs and sea legs, for my own part I should very much prefer to have a superior class of men if they can be got by a moderate retaining fee. I do not know that I have any further remarks to make, except to thank Captain Brent for the great trouble he has taken in preparing this elaborate paper. It will be a very valuable addition to our Journal, and I only wish there had been more members, especially of the naval profession, present on this occasion.

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Journal R.U.S. Institution
Vol. 18

Fig. 1. — "Victor Emanuel" outline sketch of Ventilation

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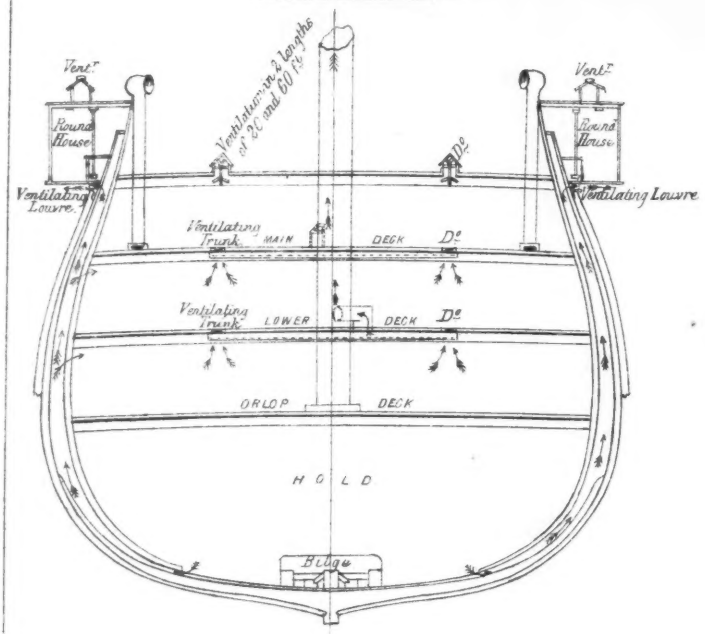

Fig. 3. — Section of a ship showing Dr Macdonald's proposal for Ventilation.

See his paper read at the Institution, on the 12th of Feb. last.

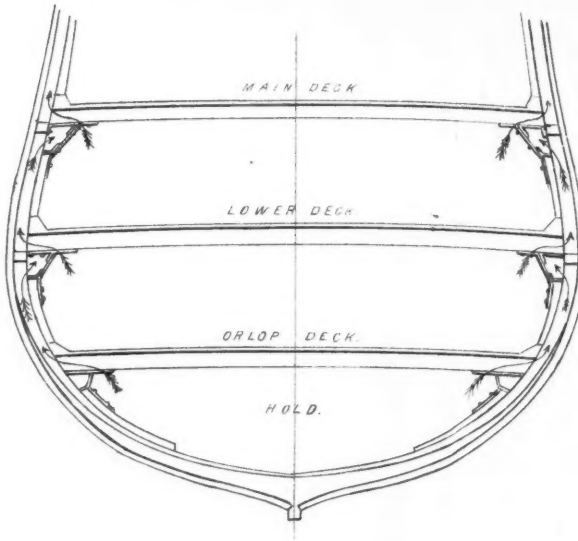

Fig 2 — "Victor Emanuel"

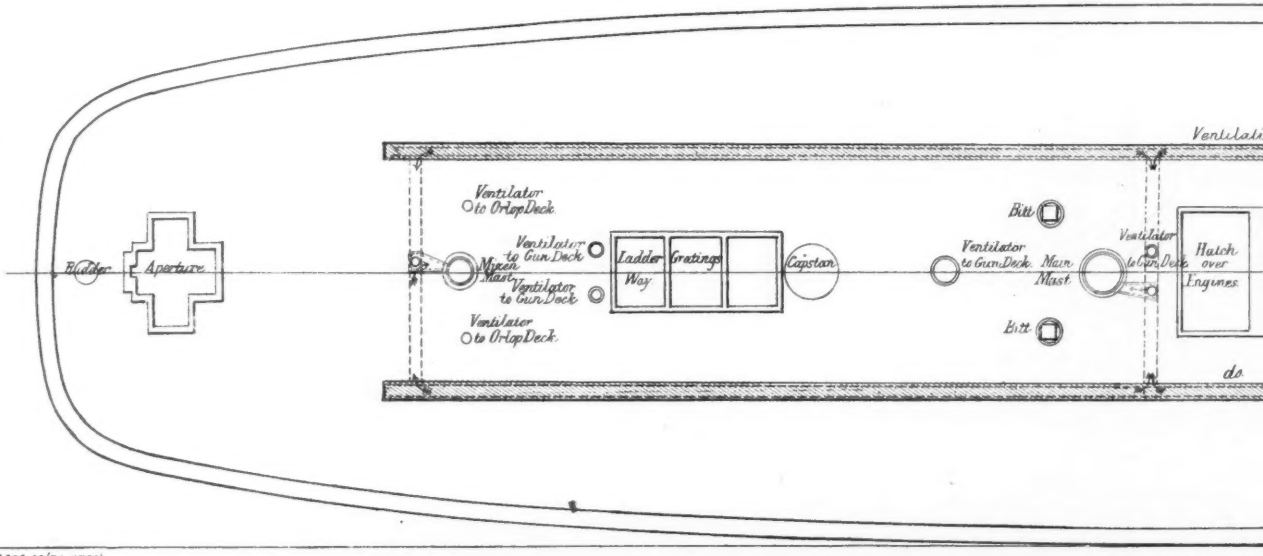

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Fig 4.—"Victor Emanuel" outline sketch of Ventilation with proposed additional fittings.

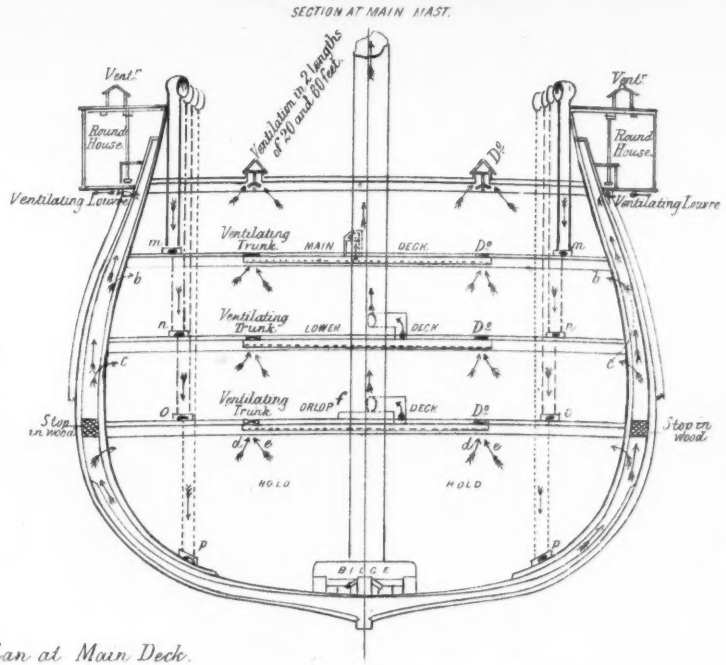
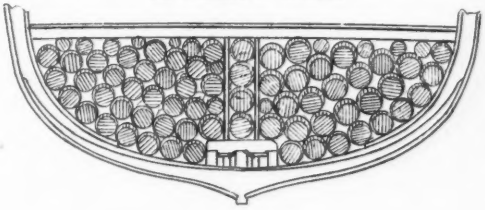
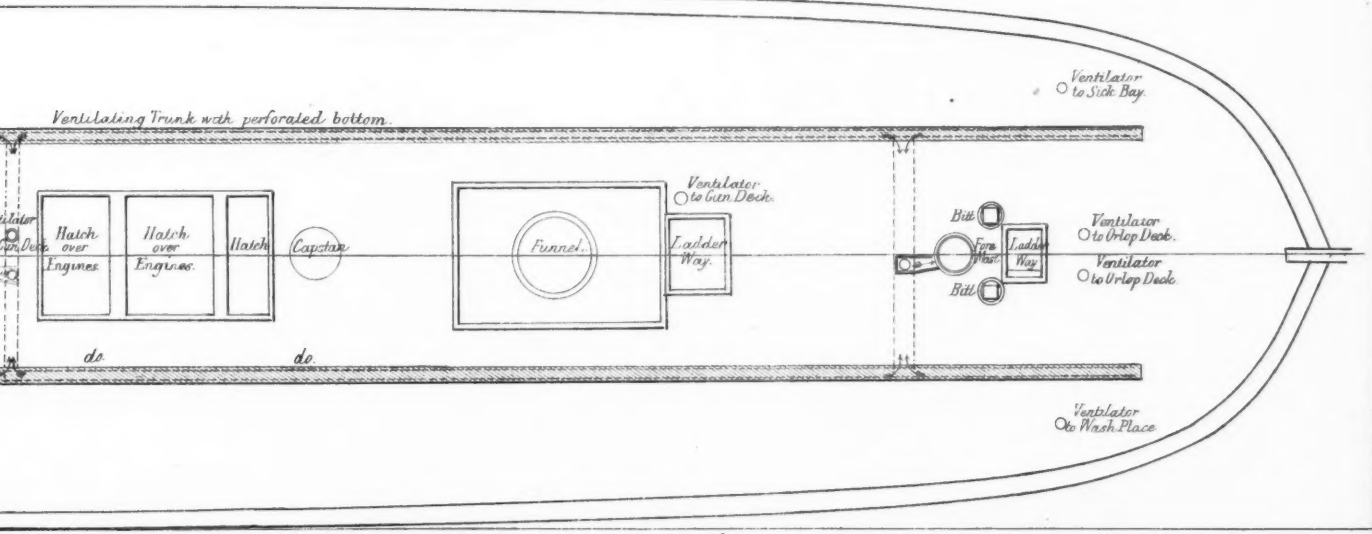


Fig. 5.—Section of Iron Mast with Diaphragm dividing the mast into three chimnies

Fig. 6.—The Hold with proposed Central Passage the breadth of a cask.



...Emanuel" Plan at Main Deck.



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LECTURE.

Friday, May 29th, 1874.

SIR ALEXANDER ARMSTRONG, K.C.B., LL.D., F.R.S., &c., Director-General Medical Department of the Navy, in the Chair.

THE FITTINGS OF HER MAJESTY'S SHIP "VICTOR EMANUEL," AS AN HOSPITAL SHIP DURING THE LATE ASHANTEE CAMPAIGN.

By Vice-Admiral A. P. RYDER.

IT was hoped that Captain Parkin, who commands H.M.S. "Victor Emanuel," would have read a paper on this subject; he could have answered much better of course than I can any questions about her, but she is, it is believed, under orders for China, and he has not been able to find time to do so. Having suggested that a paper be read on this subject, I had therefore to undertake to prepare one and visited the ship for the purpose. I hold myself responsible for the contents of this paper and for the statements in it.

The object I have had in view is threefold.

(1.) To place on record the successful fittings of Her Majesty's ship "Victor Emanuel," for the use of my brother Officers abroad, who may be called upon suddenly to devise and superintend the fittings of a hospital ship, far removed, perhaps, from access to the Construction Department of the Admiralty.

(2.) To point out, as far as I have been able to ascertain them during a short visit, what fittings were unsuccessful and require alteration.

(3.) To afford an opportunity for discussion on Dr. Macdonald's paper, read here on the 12th of February last, which may, perhaps, aid us in arriving at the best system of ventilating all classes of ships, hospital ships, low freeboard ironclads, &c., &c.

The following account of the fittings has been in part extracted from the columns of the *Lancet*, November 22, December 6, 1873, and April 18, 1874, by permission of the Editor; corrected in some minor particulars by the explanations of Dr. Marston, on the Staff of the Director-General, at Whitehall, and in others by the writer after a recent visit shortly after her return from the Coast.

When Her Majesty's ship "Victor Emanuel" was chosen, the Medical Department of the War Office were requested to signify their wishes as to her equipment, and from the commencement of the work no expense, no mental, manual, nor clerical labour, were spared to send to the West Coast of Africa a very complete hospital ship for the benefit of our fighting men.

The following description was mainly prepared by a gentleman who, though not belonging to either service, has had very large experience in the sanitary arrangements of troop, emigrant, and war ships of all classes, both at home and abroad, and who was specially sent by the Editor of the *Lancet* as a Sanitary Commissioner to inspect the "Victor Emanuel," by permission of the Admiral Superintendent of Portsmouth Dockyard.

Her Majesty's ship "Victor Emanuel" is a wooden screw steamship of the old class, of 5,157 (3,087) tons, 2,414 (600) h.-p., and carried originally 79 guns. She had a complement, as an hospital ship, of 240 Officers and men. She was launched at Pembroke Dockyard in September, 1855, under the name of the "Repulse;" but having been, shortly after the close of the Crimean war, visited and admired by the King Victor Emanuel, she was ordered thenceforth to bear the name of that monarch.

It is not necessary to record her special services afloat. The work of converting her into an hospital ship commenced on the 15th of September last.* The ship was in the first instance caulked throughout, and her bottom and sternpost were thoroughly repaired. She is now a flush-decked ship, with a poop added; and has below, for what may be called service work, a main, gun (or lower), and orlop deck. Proceeding from above downwards, we commence aft, and find under the poop the stern cabins on the port side assigned to the Captain of the ship, and the starboard cabins to the military Officer in command. The Surgeon-Major, who will have a staff of some six or seven medical Officers, as well as a still larger staff of subordinates, occupies two small side cabins.

The general arrangements of the Officers' quarters are very good; and baths, as well as closets with special ventilating and disinfecting arrangements, are provided on both sides of the poop. On the latter, on each side amidships, are four large water-tanks, raised so as to be quite clear of the upper deck. Each of these tanks will hold two tons of water. Three of these large reservoirs will contain salt water for flushing the closets; three, fresh water for washing and bathing purposes; and the contents of the remaining two will be sent into Crease's patent filters for drinking and cooking purposes only. Elaborate sets of pipes extend from these tanks in all directions over the ship—to hospital-decks, bath-rooms, galleys, saloon, and surgery; thus salt, fresh, or filtered water can, by means of these arrangements, be obtained at any moment in any part of the vessel. Immediately abaft the mainmast a hatchway has been cut in the deck for the special purpose of lowering the sick or wounded to the quarters below, the arrangements in connection with which appear to be very complete. The amount of enlargement necessary

* She sailed on the 30th of November, 1873, anchored off Cape Coast on the 1st of January, 1874, started on her return to England on the 26th of February, 1874, and arrived at Spithead on the 10th of April, 1874. During her stay on the coast, the thermometer did not rise in the shade above 87° Fahr., but the air was so charged with moisture, that boots blacked in the morning were covered with green mould in the evening.

for an entry-port to the hospital deck may possibly have been open to objection on the part of the Admiralty. The accommodation ladders and all the hatchways are very spacious and contrived to give a minimum of difficulty to all engaged in the work of transferring the sick from boat to ship.

Proceeding forward along the upper deck, we find on both sides of the ship an admirable arrangement of latrines, just abreast of the smoke-stack, well protected, opening "for'ard" (the bow port), and very well ventilated. Further on, on the port side, are the various departments of the laundry, enclosed, but well supplied with skylights, ports, and screened ventilators. The foul linen is hoisted in a closed bucket from the hospital deck below, and sent at once into the washing-chamber, which is fitted with Bradford's apparatus. The drying-rooms adjoin the washing-room, and it suffices to say that this part of the floating establishment will, we believe, if properly conducted, prove a very great success.

The starboard side on the forward part of this deck is occupied by a very convenient "butchery," and a large hospital lavatory, the arrangements of which might be examined with pleasure and profit by all connected with the organization of similar institutions ashore or afloat, and do infinite credit to all concerned.

There is a slop-room, provided with a large tank and trapped pipe, for cleansing soiled hospital utensils, which will be carried up from the hospital deck in a galvanized iron box through a scuttle to this part; and another room, communicating with the hospital deck by a trap, admits of the removal and storing of the hospital mess utensils.

This description includes pretty well all that is worthy of notice on the upper deck. We may here observe that all other parts of the ship are, by means of "trunked" hatchways, entirely cut off from the hospital proper, and that in no single instance does any general discharge-pipe lead into a soil-pipe.

Before going below we remark that two planks have been removed from either side of the upper deck, fore and aft, to the extent of about 79 feet. The open spaces or slits thus formed are protected by combings covered by long wooden hoods, which, by means of nuts and screws, can be raised or depressed to any extent up to 8 inches in order to ventilate the main (hospital) deck by acting as a large and very efficient *up-cast*. This resembles the ridge ventilation so commonly adopted in hospital huts, and, as the cover is subdivided into four parts, each portion can be raised separately, so as to admit of the degree of ventilation being regulated to different sections of the hospital deck, when this part is divided, as it is intended to be, by movable screens scalloped at the top.

We may now go down the aft companion ladder to the main deck, which is of course the most important division of the floating hospital. The height from deck to beam is 6 feet 2 inches, and from deck to deck nearly 7 feet. The extreme length is 230 feet, and the width 52 feet. For purposes of ventilation as well as of light there are 66 ports, $3\frac{1}{2}$ feet in height by 3 feet wide, and five scuttles, each 8 inches

in diameter. The ports are fitted with sashes and jalousies, either or both of which can be raised or opened, shipped or unshipped, at pleasure. General ventilation will be assisted by the hatchways, and by two large stern ports. Direct down-cast ventilation will be effected by means of seven cowled tubes, each 18 inches in diameter, projecting some feet higher than the bulwarks, and trimmed, of course, "head to wind," the lower openings being brought down to within about 8 inches of the floor of the hospital deck, so as to diffuse the air without causing a draught. The up-cast ventilation will be promoted by the long open spaces above described, and by numerous tube orifices along the top sides of the deck above, which will discharge the foul and heated air through goose-neck pipes.*

The engine-room hatchway is completely "trunked" off by glazed bulkheads, so that no heat from this source can find its way on to the hospital-deck.

There is a set of cabins on each side at the stern,† which will be used by sick Officers, but the rest of the deck, except of course amidships, presents a clean sweep fore and aft. The interval between the sick Officers' cabins is to be provided with large stern windows, capable of being kept wholly or partially open; and this part admits of being screened off from the remainder of the hospital-deck.

The baths are placed amidships in three or four sets, and are provided with pipes to convey salt or fresh water from the deck tanks above described, with steam jets to heat the water, all the taps being conspicuously lettered.

The lavatory arrangements consist of two long rows of wash-basins forward, fixed on either side of the bowsprit, each supplied with salt or fresh water, and there are, as well, basin-rings screwed to the sides of the deck for emergent purposes. The closets are arranged in three sets on each side of the vessel, and there are no fewer than four for the Officers and 28 for the men, making a total of 32 on this deck. Two sets are fixed aft, two at the bows, and two about opposite the engine hatchway. They are furnished with patent pans and disinfectors; each is ventilated by means of a goose-neck up-cast; the lower outlets have a good angle of inclination, and are of large diameter, and there are ample means provided for flushing.

The deck will accommodate 140 patients, occupying cots arranged in three rows fore and aft, on each side of the deck, with about 2½ feet of gangway space between each row. The cots will be hung to short iron staunchions screwed into the deck below, and the cots will all both "rock"‡ and "lock."

* When the "Victor Emanuel" reached the Coast, the two foremost water-closets on each side were removed to give freer ingress to the breeze when the ship was head to wind, the two hawse-plugs were removed, and two openings of considerable size were fitted to lead to the hospital deck sidewalks, which were always kept open.

† Experience on the Coast showed that it would be better not to have cabins on the deck, as they blocked up the ports.

‡ It was found that, when the mattress was on the bed, and a patient also, the centre of gravity of the bed was so high that the stability was entirely lost; the bed had to be always locked or re-slung with rope grummets. There were 50 beds for the poop, to stand on legs.

Every iron cot has been fitted not only to rock and lock, but to be removable at will; there is no reason why the spare ones should not be taken down and stowed away; and under these circumstances it was deemed best to provide fittings for a maximum number.

A certain proportion of the cots are constructed especially for certain classes of surgical and medical cases.

The sick cots for surgical cases were used in the Abyssinian war. They have *movable* and not *fixed* sides, and are furnished with a trap-door. These cots have been distributed on the hospital-deck in such a way that no two of them are contiguous, and they are placed in the position best adapted for ventilation.

Mosquito curtains will be provided of a light material, rendered uninflammable by tungstate of soda, but most of these will be made up from patterns during the outward passage. Light canvas screens will be also provided, so that by hooking up one of these any single patient, or set of patients, can be isolated from the rest.

The hanging screen, which will be rigged up "athwartships" for the purpose of separating the Officers from the men, will be lowered only under exceptional circumstances and for the short period of time that the sick Officers might desire to secure privacy. This was one of the requirements made by Medical Officers who had served on board other hospital ships. For though privacy is a privilege much appreciated, especially on board ship, the value of stern ports cannot be exaggerated, and any obstacle to their use, whether as inlets or outlets, will vastly influence the purity of air between decks, whether the wind is ahead or fair, and whether the ship is sailing, steaming, or at anchor.

A clean sweep of deck fore and aft is most essential, and such will be the case when the canvas screens are rolled up, as they are ordinarily intended to be; and they have purposely been deeply scalloped at the top and left free of the deck at the bottom, so as, when down, to intercept the current of air as little as possible. But the chief explanation of the presence of these screens and of the American stoves is this:—At the end of the campaign the ship will have to convey the sick to this country. Patients recovering from tropical fevers and dysentery are, as is well known, very susceptible of the effects of cold, and they may have to encounter the danger and discomfort of a voyage home at the most inclement season of the year. With the number and variety of natural and artificial sources of ventilation in this ship, it was felt that there should be some means for protecting the sick against the effects of a colder latitude. With thermometers to indicate the temperature, and doctors to direct at what degree it should be maintained, the sick attendants cannot go very far wrong.

The dispensary is built up forward amidships, is 17 feet 9 inches in length and 10 feet in width, well lighted from above, and is being fitted up with all medicines and necessary appliances by Messrs. Savory and Moore. The sides and flats of this deck are coated with white zinc paint, so that they can be kept clean by ordinary scrubbing.

The reasons for having the whole of the hospital-deck painted white*

* The writer of the article in the *Lancet* objected to the coating of white paint on

were—that there is nothing like a white surface for showing dirt; that paint renders the wood non-absorbent; that any part of the deck can be washed with soap and hot water; that white paint is common, cheap, and readily renewed; and that for a hot climate it is the coolest colour that can be selected. With the jalousies specially provided to exclude the sun's rays, without impeding the ingress of air, it is to be hoped that no one will be inconvenienced by the "glare."

A special feature in the arrangements of this hospital-deck is the erection on each side, at about the centre of the vessel, of a large outside platform, on which several of the sick can be placed, either in beds or chairs. These platforms are protected by a sort of fine wire fencing, and might fairly be the "birdcage-walk."

Our description of the main-deck is, we believe, complete when we mention that several of Crease's patent filters (which were described in the *Lancet* some months ago) are placed here, as in many other parts of the ship, as well as a very complete set of fire-pumps.

We may now descend to the lower or gun deck. Commencing aft, we find that the port side of the old gun-room is fitted with seats, lockers, and berths for the use of the hospital sergeants; that accommodation is provided for sixty convalescents between the sergeants' quarters and the chain-lockers, and that the convalescents will all sleep in ordinary swing cots, hung as usual from beam-hooks, and will have mess-tables fixed athwartships, as in an ordinary transport.

A special system of ventilation is adopted on this and on the orlop deck which is worthy of particular attention. Two strakes of the main deck flooring have been taken out on each side, fore and aft, for 180 feet. In this space a hollow iron trunk has been inserted, which communicates by means of numerous and large circular apertures with the deck below, *i.e.*, the deck to be ventilated.* Each trunk again communicates with transverse shafts, which latter conduct the foul air into the hollow iron masts and the funnel casing, and so up into the external air.† The plan adopted is, in fact, a modification of Dr. Edmond's system, steam-jets not being used.

The berths for the crew are on the gun deck from the mainmast forward, and bulk-heads, with lock-up doors, will separate them entirely from the convalescents and from all hospital arrangements. The downcast ventilating arrangements are precisely similar to those on the main deck, there being five tubes, each of from 12 inches to 16 inches in

account of the glare in the tropics, suggesting that it should be toned down. His opinion was confirmed by experience.

* So successful was this that the air from the holds passing up through the skin was drawn into the Officers' cabins through the holes over the shelf-piece, and being charged with gas from the bilge-water, was both disagreeable and unwholesome. It became necessary to allow the holes to be stopped up.

† When sail was set, the ordinary upward draught of air through the masts and on which the whole ventilation of the holds, lower and orlop decks, hospital, &c., depended was reversed; this must be remedied by providing the mast with dampers, and some fittings which will allow of the free egress of the vitiated air when sail is set, and also fittings to enable artificial ventilation to be brought into play to supplement the ordinary natural ventilation under the above circumstances.—A. P. R.

diameter, as well as sixteen square ports and ten scuttles, each of 8 inches in diameter.

Lower still to the orlop deck, below the water line, and in the region of perpetual gloom, albeit where nearly all our naval Officers used to have, and many still have, their quarters at sea. The orlop deck of this ship will be occupied by the hospital issue room, the medical comforts, the wine stores both for hospital and saloon, the hospital medical store, the utensil store, the wholesale drug store, and the troop and hospital bedding store. Some of the Non-commissioned Officers and crew are berthed here, and the system of ventilation adopted is similar to that on the gun deck, a collecting trunk being inserted for up-cast duty, and four large tubes for the down-cast work.

We penetrated deeper still, and found the starboard shell-room converted into an ice store, the after magazine into an extra wine store, and the "handing-room" of the magazine into a linen store. And now about the bilge. We descended to the "end of all things"—*i.e.*, the keelson, along and at the sides of which Portland cement has been applied. The whole was then lime-washed, and afterwards washed with a solution of carbolic acid. At the time of our visit a sponge might have been drawn along the keelson without taking up any appreciable amount of water.

Returning to daylight and to the upper deck, we have yet to notice the arrangements of the galleys (or cook-houses). They are placed between the fore- and main-masts, just abaft the funnel and over the old engine-hatch. The hospital galley is very spacious and complete; there is a washhouse and a bread-room adjoining the galley, and the poultry will be carried above, in the place usually occupied in merchant ships by the "long" boat. Salt and fresh water are laid on here, as everywhere; and Crease's filters pervade this deck as well as those below. The galley is also provided with special scuppers, so that no bucket work or slopping of any kind about the deck will be necessary.

It is almost a work of supererogation to record that the ship is amply provided with Massey's, Downton's, and other pumps in great number and variety, for pumping bilge, washing decks, flushing closets, and extinguishing fire. The ship will be provided with double awnings, fore and aft, two feet apart; but side flaps will not be used. These awnings will cover the vessel from stem to stern, subdivided, however, to admit of the ventilating tubes communicating with the external air. The aft part of the poop, beneath the awning, is to be used, in case of need for infectious diseases, and provided with a screen, ropes, and sentry. It is intended to utilise the upper deck for hospital purposes if required.

On a second visit, three days before the "Victor Emanuel" sailed, we descended to the main or hospital deck by the hatchway just abaft the mainmast, constructed for sending below the sick and wounded, and found the cots all slung fore and aft in three rows on each side, and a specially convenient hand-rope over each cot. Here and there were cots for particular cases, with rests and fixed sides. All have small head table boards, which can be shipped and unshipped at pleasure. Many of the canvas screens were fixed to the rods above, but rolled up, and have scalloped tops, so as, when lowered, to impede

ventilation as little as possible. This deck is also furnished with six of Messrs. Deane and Co.'s 16-inch American stoves, which may be useful when the vessel is passing through cold latitudes. The deck will be lighted by twenty-six Palmer's candle lamps, hung clear of the gangways. All are so placed that their glare will not fall upon the eyes of the patients immediately below, and they will be unshipped during the day. The closets have been ventilated with 14-inch pipes, which will act as up-casts, and have goose-necks above the upper decks. The floors immediately below the closets have been coated with cement, so that all accumulation of damp deposit external to the apparatus may be prevented. And, finally, slides have been provided for the perforated spaces near the floor, to be used if required.

The night-stools on the convalescent deck are only intended to be used under exceptional circumstances, as for instance, for convalescents from dysentery, and as water-closets would have been most objectionable on this deck, night-stools had to be furnished; but they are intended as *night*-, and not day-stools. The "night-stool" is a portable water-closet, with a well for a disinfecting liquid, a pump, and a means (fish-tail) for discharging this liquid on the excreta as the pan is depressed. The receptacle is of metal, and fitted so as to be sealed when covered. With the efficient medical staff on board and an abundance of well-trained subordinates, it is believed that the objections to these hospital utensils may be overcome, or, at any rate, reduced to a minimum.

As the ventilation of the Officers' sick quarters on this deck aft appeared to be defective, perforated zinc spaces have been cut, opening into the screw well, which will serve as very efficient up-casts, if the slides with which they are also furnished are seldom or, as we hope, never used.* This part of the deck is abundantly provided with seats, shelves, and various other conveniences.

We omitted in the former description to explain that the "birdcage-walk" on either side of the vessel is got at very easily, inasmuch as one of the ports has been cut to form an exit nearly six feet high, which might be used, as we believe, more conveniently for the entry of helpless cases than the hatchway specially constructed for that purpose. The utmost care appears to have been expended on the little but very important items of hospital arrangements. The cots are numbered on the beams above. There is an arrangement for lifts between the hospital and upper decks, by which the foul linen will be sent up in closed galvanised iron boxes, and, if necessary, plunged at once into boiling water. These lifts will also be used for removing the hospital utensils, &c., and so greatly economise labour and prevent dirt about the decks.† The water tanks here and everywhere are conspicuously lettered, so that "what we shall drink" need be no mystery to any one on board, and the way to obtain it is equally patent and simple. The down-cast ventilators are all furnished with deep saucers, to provide against sudden squalls. The fire hose and buckets are all snugly but very conspicuously hung. The dispensary, which opens on

* These had to be closed, the smell was so offensive, and other means were adopted.

† These lifts were never used; it was found preferable to carry up aloft.

to both sides of the deck, is in good sea-going trim. And, finally, the deck has been lined throughout, above and below, from stem to stern, with a coat of white paint.

Having finished with the hospital deck, we took a last turn below. Here, on the gun deck, the ventilation had been considerably improved by the introduction of a special down-cast and up-cast into a sort of cul-de-sac near the chain lockers immediately abaft the engine-hatch, and as the mainmast is close at hand, this up-cast runs into it about two feet above the deck. We omitted to mention, in connection with the ventilating arrangements of this deck, that there are two ports at the stern, and two at the bows.

One of Messrs. Siebe and West's ice-making machines* has been fitted on board. (It is an ether machine.) This machine, which has an engine of its own, was, at the time of our visit, in full working order, and will manufacture nearly half-a-ton a day, in 48-inch slabs, which will be stored in the ice-room close at hand.

The laundry staff were in full swing with Messrs. Bradford's washing apparatus; and the blue-jackets and marines had, apparently with very favourable results, tested the culinary properties of the galley.

Proceeding forward on the upper deck, there is little but praise to bestow. Tanks, galleys, washing apparatus, slop and washing rooms, are all excellently arranged, as are also the urinals and latrines, although there appear to be too few of the former, for it should be a cardinal point in all vessels not to allow any person whatever to use the closets below if able to come on deck. The lifts between this deck and the hospital proper will be very valuable for the purposes above described.

And now for the hospital deck, the ventilating arrangements of which are, of course, superlatively important. We enumerated in our last report the number and variety of natural and artificial sources of ventilation adopted as to this deck, all of which, according to our opinion, can be constantly available except in very heavy weather indeed, when it might be necessary to close the ports, and to lower the up-cast ridge coverings. And, as we take it, the designers of this hospital have taken advantage of every available means for inducing constant air movement between decks, although it is almost as difficult a matter to compass when the outer atmosphere is nearly stagnant, and the thermometer at 90°, as to supply the crew of the "Devastation"

* It was found that 480 lbs. of ice were made per day, at a cost of 2*d.* per lb., a very small price to pay for such an essential in cases of fever, &c. The annual consumption of fuel, for condensing and all other purposes at anchor, was 3½ tons per day. The result of experience proved that it would have been better to have had the ice-machine on deck in place of the lavatory. The hot water from the condenser of the ice-machine would then, instead of running below, and being, as was the case, the fruitful cause of bad smells, have been discharged overboard instead: by its action on the wood, a "very bad" smell was created in the bilge, although several of the crew were continually employed cleaning it. The unavoidable hurry at the last, prevented this being remedied before the ship left England. It may be well to state, as a matter of comparison, that in England ice has lately been purchased wholesale in London at the rate of three shillings per cwt.; but the retail price is of course higher.—A. P. R.

with fresh air when their hatches are down, and their ship set in order of battle. It is perhaps hypercritical to add that one or two fans with corresponding shafts, similar to those fitted to the monitors, might have been put into this ship for emergent purposes. But with all the admirable arrangements already provided, it is necessary to look below, as well as above, so as to keep the "nethermost" parts of the ship as free from bilge and foul air as they were when the vessel sailed. This is, perhaps, less thought of now than formerly, since iron has superseded wood afloat.

Generally speaking, the extent to which the ventilation has been placed under control has been advisedly adopted, in consequence of the confidence with which it was felt that this might be left to the discretion of the medical officers on board.

The number of closets is large;* for, as will be recollected, there are no less than four for the Officers and eighteen for the men. The difficulty of keeping clean closets, "heads," and latrines on board ship can hardly be estimated by any who have not served in a vessel carrying invalids, troops, or emigrants; and, as is known by experiences gleaned in the "Dreadnought" and other smaller institutions of the same class, stationary floating hospitals are no exception to this remark. Under ordinary circumstances, several of these closets can be closed up (*e.g.*, one of each set), for it is probable that those of the sick who are well enough to use them, and not well enough to go on deck, will be very small, bed-pans in many cases being absolutely necessary.

The dispensary is very well lighted, and will serve also as an operating room in case of need.

We believe that the authorities have exercised a wise discretion in omitting in their arrangements a mortuary and *post-mortem* room. Death in the tropics, and especially aboard ship, is followed so speedily by burial, that all necessary arrangements can be readily made by utilising the canvas screen above mentioned, and so securing a requisite degree of isolation.†

Dr. Marston, the Officer on the Staff of the Director-General at Whitehall, was the Officer to whom was specially entrusted the responsibility of supervising the medical and hygienic arrangements of the ship, and proved himself fully equal to the occasion.

It is very important not only that the plans and specifications of the fittings be preserved, but a working model made. This country has never, and probably no other country has ever, sent out a floating hospital so carefully planned. It is of the greatest consequence that an exact record should be preserved for future guidance, as it seems probable such vessels will be largely employed in all future wars.

Our Government has been accused of parsimony, but in this instance no charge of that kind can be brought against it. Nothing more could have been done for our troops, and all concerned in the fitting out of the ship deserve the greatest credit for their exertions.

The above description, chiefly from the pages of the *Lancet*, of the fittings of the "Victor Emanuel," is, I believe, accurate and exhaustive.

On the 13th of February of this year, Dr. Macdonald read a paper

* One in each batch was found sufficient.

† A mortuary and post-mortem room was fitted on the upper deck.

here, at my suggestion, on the "ventilation of ships, especially low-freeboard and hospital ships." I had in my mind when I suggested that a paper on that subject be read, that the return of the "Victor Emanuel" would afford an opportunity for recording her fittings, and for a discussion on Dr. Macdonald's paper; that opportunity will be afforded this afternoon. The number of the *Journal** in which that paper appears has only been issued within the last few days, and has probably not been read by more than a few of the members; it is well deserving of the attention of the authorities of any country possessing a navy, and of every English Naval Officer. There is in it a great deal of information, but what struck me most forcibly was that there is evidently as yet no final agreement in opinion on the part of those who have made the ventilation of ships their study, as to what is the best way of effecting it (see p. 137), where Dr. Macdonald informs us that "good authorities are still divided in opinion on the subject," and at page 141, where he informs us that "the magazines in most "ships are ventilated on a system which obviously demands a radi-"cal change;" again at page 143, where he speaks of "currents of "impure air constantly rolling into cabins of Officers and the sleeping "places of the men, to mingle with air already contaminated with the "products of respiration, combustion, &c., and for the escape of "which no rational provision is provided;" again at page 146, after describing the system adopted in war ships, "Devastation," "Glatton," &c., as the "plenum" system, he says that "there is no special pro-"vision made in them for the removal of vitiated air in either of the "ships referred to, after its more or less complete diffusion, it must "find its escape as best it may;" again, at page 147, referring to low freeboard vessels, he says,—"The whole subject is indeed so new, and "involving as it does considerations upon which good authorities are yet "at issue, that I would approach with caution any criticism as to the "detail of the system carried out in the ventilation of our *low freeboard* "ships.

Dr. Macdonald concludes by stating his conviction that the "system "of extraction would be found to be much more satisfactory than the "plenum system, as applied to the ventilation of our low freeboard "ships."

The Chairman, Admiral Sir R. S. Robinson, the late Controller, than whom we could find no one who has enjoyed better opportunities of forming an opinion, wound up his concluding observations with these words:—

"For my own part, I believe the true principle of ventilating ships "as well as buildings is the principle of *extraction*, and you will really "do very little good unless you thoroughly and completely adopt the "system of getting rid of the foul air, by artificial means, if you please, "and leaving the supply of pure and fresh air to natural means, which "will be easily accomplished."

Now as all our low freeboard ironclads are ventilated, not on the "exhaust" principle so strongly recommended by Sir R. S. Robinson and Dr. Macdonald, but on the "plenum" principle, I think I may safely say that this very important question has reached a stage when some

* Vol. xviii, No. 76.

solution should be found, and for this purpose some further experiments tried, with the view of enabling us to see our way. The fitting of the "Victor Emanuel" as an hospital ship is such an experiment as regards *hospital* ships, and it may help us towards improving our present method of ventilating our low freeboard ironclads.

It is not an easy problem; it is now in ships of the latest construction—low freeboard ships—much more difficult than it used to be, and especially in low freeboard ironclads, as "Devastation," "Hotspur," &c., without side ports or scuttles. I will, in speaking of ventilation of ships, adopt the names used by Dr. Macdonald, and speak of "*natural*" methods of ventilation and "*artificial*" methods of ventilation, and divide these again into "plenum" and "exhaust" methods.

By "*natural*" methods I mean those in which, after expense has been incurred in fittings, the ventilation is left to nature, to currents of air created by the laws of nature, without any assistance that costs money—such as fans driven by machinery, either to force in air or abstract it, or suction created by the action of furnaces heating and rarefying the air.

Arrangements for *natural* ventilation in a room consist, as a general rule, in affording means for the exit of the vitiated air at the top of the room, and for the ingress of fresh air lower down, thus setting up a circulation of air. This system is exemplified on board ship by the old-fashioned wind sail, and as no special means existed for facilitating the escape of the vitiated air, this system may be called the "natural plenum" system. There is also the "natural exhaust" system, in which the fittings for facilitating the escape of the vitiated air are the only or the prominent features. This is exemplified in the "Victor Emanuel," where, although there are air tubes and cowls, the three masts and funnel for the "exhaust" are the prominent features of the system. As regards the funnel, the current of air passing through it is no doubt accelerated by the heat from the furnaces, and to this extent the system adopted in her is the "artificial exhaust."

The *artificial* means of ventilation may also be divided into those that force in the fresh air, the "plenum" system, as described by Dr. Macdonald, and the "exhaust" system, which abstracts the vitiated air through pipes, there being tubes and cowls for the ingress of fresh air. This was the system advocated by Dr. Edmonds, who used jets of steam to aid the exhaust. For a detailed account of Dr. Edmonds' system, as adopted in our Indian troop ships, see end of paper.

When I visited the "Hotspur" some time since, I found that the artificial "plenum" system had been adopted. It is to be found, I believe, in all our low freeboard ironclads, and may perhaps be the only possible system in such vessels—as there can be no opening to the outer air except amidships—and the furnaces have therefore to be relied upon to create an exhaust.

The "artificial exhaust" system has been largely adopted in France, in the ventilation of prisons, and notably at the new opera house, also in cattle ships, and, it is said, with success. I will refer later on, to this method as adopted in France.

A thoroughly efficient "natural" means of ventilation would be a

great boon, because after the first cost it would be inexpensive and automatic; but as yet it has not been found that we can rely with certainty on the action of natural causes alone to ensure that the currents of air shall always flow in the required direction at the required speed, and this speed easily controllable. The current sometimes reverses its direction. This took place in the "Victor Emanuel" when sail was set, and the air descended through the iron masts instead of ascending, as was intended, and had always previously been the case.

The "Victor Emanuel" is ventilated, I have stated, on the "natural exhaust" system, the exhaust being for the main deck through a long slit in the upper deck, 80 feet by 12 inches; from the lower deck and orlop deck through horizontal pipes into the lower masts; from the bilges and holds partly through the holes in the skin, over the shelf pieces into the Officers' cabins and orlop deck.

This latter was an oversight; it caused great annoyance, and was corrected by these holes being allowed to be hermetically closed. It was no doubt owing to the thorough ventilation of the lower and main decks up the masts that the draught from the bilge through the skin into the Officers' cabins was caused.

An outlet for the vitiated air from the bilge, after ascending through the skin, was made in the "Victor Emanuel's" upper works, outside, where various jalousied openings may be seen; but the vitiated air in the bilge frequently preferred, as I have already stated, to escape through the openings over the shelf-piece into the Officers' cabins, yielding to the solicitation of the reduced pressure of the air on the orlop deck and on the lower deck, owing to the vent up the centres of the masts.

I ascertained by letter from the French Minister of Marine that "artificial" ventilation on the "exhaust" principle is being tried in a horse trooper, the result not known yet. I have since learned that some of our cattle steamers are successfully ventilated on the "artificial exhaust" system. All the four methods, two "natural" and two "artificial," have therefore been tried on board ship, with various success.

Plans of Ventilation.

I. Natural.	1. Plenum..	Example: The old-fashioned wind sail.
	2. Exhaust..	"Victor Emanuel" primarily; but she combines also 1 and 4.
II. Artificial	3. Plenum..	Our low freeboard ironclads. The House of Commons.
	4. Exhaust..	Some cattle steamers, a French cavalry trooper, and numerous large public buildings in France.

III. Combinations of the above.

There are two varieties of the "artificial exhaust," viz.:—

(*a.*) Exhaust, upwards. Example, the old House of Commons. The air is now introduced through the carpet; refrigerates the legs of the Members, and carries the dust from their boots to their mouths and nostrils. These must be very doubtful improvements.

(*b.*) Exhaust, downwards. Example, French public buildings. The natural process is reversed, and vitiated air is sucked downwards; fresh air admitted above. This plan is most generally approved of, and would apparently be well suited for steamers' cabins and for hospitals, as the vitiated air, instead of rising from the beds to the respiratory organs of the medical attendants, the nurses, and the other patients, would be instantly drawn downwards to the floor, and find vents through the openings provided for the purpose in the skirting board.

Wooden ships and iron ships require of course different treatment. In the former we have a hollow space between the two skins of the ship, purposely left open to secure ventilation and preserve the wood from dry rot. In the latter, except when there is backing to armour, we have nothing but the thin iron side of $\frac{5}{8}$ or $\frac{7}{8}$ of an inch between us and the water. In the former the necessity of ventilating this space between the two skins obliges us, while seeing to the ventilation of the decks, not to overlook the ventilating of the space; in the latter the question is simplified.

Having read to you the statement in detail of the fittings of the "Victor Emanuel," it is only right to state that the medical Officers on board considered that her sanitary condition was irreproachable during her short stay on the coast—there were no cases of hospital fever, or anything to show that she was otherwise than in a satisfactory condition. The percentage of sick among her crew was not greater than in ships on the home station; diarrhœa attacked one-third of the crew at one time, but yielded to change of diet. No leave was given, which accounted in great measure for the good health of her crew, but made it difficult to understand how it came to pass that remittent fever and dysentery attacked a few of the ship's company (four), cause not ascertained. Great care was taken not to expose the men to the sun; rest was enforced for $2\frac{1}{2}$ hours in the middle of the day; the latrines and bilges were cleansed with carbolic acid solution. On the other hand, it must be remembered that she was only there for a few weeks in the most favourable season; that the thermometer never stood in the shade on board at more than 87° F.; and that she was rarely full of sick.*

The useful question to ask is, have we drawn from the experience of the "Victor Emanuel" any useful lesson? Should we, if we were fitting out another hospital ship, or refitting the "Victor Emanuel" for another term of hospital service, make any, and, if any, what change, or was she in every way perfect?

The old wooden line of battle ships are admirably suited for hospital ships, and for many years to come we shall probably have a few left available for the purpose. When they are all broken up, and we have

* The "Victor Emanuel" has accommodated, since her departure, a total of 565 invalids, of whom three only died on board before she sailed for England. Of this number, 104 were discharged fit for duty, 125 were transferred to other ships, or to join their respective corps, 165 were invalided home, 167, of whom four were Officers, remained in the ship when she sailed for England. Of these only 31 were admitted into hospital when she arrived in England. Three Officers and seven men died during the voyage.

to build of *iron*, high, roomy hospital ships, it will be time enough to speculate upon how best to ventilate *them*.

The pest-house of a neglected ship is the hold; into that receptacle, all filth, if there is any, subsides, unless great care is taken to prevent it; and all water from decayed parts of the ship runs and stagnates, unless means are constantly taken to remove it; and upon the state of the hold and bilges, no doubt depends, to a great extent, the health of the crew.

It is after clearing the hold of a ship in the tropics that even the well-seasoned negro not unfrequently succumbs to the attack of yellow fever. It is the hold of the hospital ship, as of every other ship, that has to be watched. How may this best be done? I believe that a plan I adopted in every ship I have commanded is the best way of ventilating a hold; viz., to separate the contents of each hold and provision room in such a way that there is a well-defined continuous passage through the centre of the hold fore and aft (see Fig. 6). This was effected in the spirit-room, in the provision-room, and in the store-room, by two rows of stanchions with battens, as in a magazine; the tanks were also separated amidships, so that I could walk at any time along the kelson, except of course where the machine and boilers and magazine were. The kelson throughout the whole length of the ship, with this exception, was exposed to view. This passage was about 3 feet broad, just the breadth of a cask, so as only to lessen the stowage very slightly.

On first starting from harbour, full of provisions, this passage was filled up with casks, and would of course be the first cleared,—probably in a fortnight or three weeks,—after which we reached the kelson. It was one of the duties of the Surgeon to walk along the kelson of the ship, before divisions every morning, and report the ship to me as perfectly sweet and clean. In screw ships, this access to the kelson is effectually secured *abaft the engine* by the screw alley, but the above plan may be adopted with benefit *before* the engine. I copied this plan of fitting and stowing the holds from Her Majesty's ship "Vesuvius," Commander Herbert Austen, in 1848, and have often brought it under the notice of the authorities, hoping that it might be universally adopted.*

In a ship with iron masts, the masts, if connected with horizontal tubes in the orlop deck, as in the main and lower decks of the "Victor Emanuel," would carry off upwards any air that might accumulate in the bilges or in these central passages in the holds under the orlop deck. I have no doubt that all connection between the bilges and the skin should be closed, by order from the authorities (see the stop in Fig. 4); we should then never hear again of these complaints which culminated in the "Victor Emanuel" in orders from the captain to close the ventilating holes over the shelf pieces.

We may now consider the ventilation of the orlop deck and its

* I showed this plan of fitting and stowing holds to Admiral Sir W. Mends, Director-General of Transports, yesterday. It was quite new to him, and I was gratified to find that he highly approved of it. I have no doubt he will introduce it whenever it may be in his power to do so.

skin, the lower deck and its skin, the main deck and its skin, and of course in a three-decker the middle deck and its skin.

Description of Drawings.

I am much indebted to the courtesy of Admiral Stewart, the Controller, for deck and section drawings of the "Victor Emanuel," showing her fittings. I have had them enlarged (see drawings 1 and 2). No. 3 is an enlargement of the drawing given in Dr. Macdonald's paper. No. 4 has the additional fittings which I have suggested. I am under the impression that in any vessel having *iron* masts capable of being fitted for ventilating purposes, Dr. Macdonald would prefer that the vitiated air pass directly to the masts and not up the ship's skin, as in his drawings; his method would be very applicable to ships with wooden masts, but there must be two sets of cowls and tubes, one for the up and the other for the down take.

If we effectually cut off all connection through the skin of the ship with the holds and the bilge water, we might venture, perhaps, to ventilate through the skin *downwards*, reversing, therefore, the arrows in Dr. Macdonald's drawing, and taking the fresh air in, through slits, such as those on the bulwarks outside of the "Victor Emanuel," and inhaling it downwards through the skin, through the holes, over the shelf-pieces, and into the decks and cabins; but we should be exposed to this possibility, viz., that if the upward draught on, say the orlop deck, and into the mast, were stopped, then the current at *c* might be reversed (see dotted line), and the vitiated air from the orlop deck might be drawn, first through *c* and, then at *b*, into the lower deck.

It has been thought better, therefore, to admit the fresh air to each deck and hold by separate air tubes (with cowls and cups) from the upper deck, as is done in the "Victor Emanuel," for main and lower deck; each deck will then have what Dr. Macdonald desiderates independent ventilation, provided that the masts can be built or altered as I now propose. The masts should have an interior diaphragm of light galvanised iron, in this form, thus creating in each mast three ventilating chimneys, independent of one another (see drawing No. 5). The three masts would afford nine chimneys, none too many, especially if the vessel is divided into compartments.

In the sketch, the arrows *d*, *e*, *f* show the exit of air from the holds up the masts, and *m*, *n*, *o*, and *p* show the tubes for bringing air down from the upper deck. There should be balanced valves in the masts, or some other means should be taken to prevent down draught when under sail.

The existing horizontal exhaust tubes for the lower and orlop deck, the down-takes on the main and lower, the openings into the masts and funnel, would all remain the same as at present.

If it were thought necessary to increase the natural ventilation by artificial means, and provide beforehand for supplementing the natural ventilation, which appears to me to be of great importance in an hospital ship for use in the tropics, it might be effected by connecting each uptake with a chamber having fans or screws, to be driven by a donkey-engine, or by adopting Dr. Edmonds' plan, with steam jets.

Either of these plans would, when in gear, abstract the air from the hold or decks with increased rapidity.

I may perhaps be allowed to state in a few words how the French have lately ventilated the new Opera House, also a large prison for 1,000 persons. I was a juror on Heat, Light, and Ventilation at the Great Exhibition in France in 1866, and I studied the various systems then in vogue, for the French had, and probably still have, numerous ventilating professors. Ventilation is a profession in France. M. Hamlincourt was the professor, most approved of by us. His system was "artificial exhaustion" of the vitiated air, the system approved of by Sir R. S. Robinson and Dr. Macdonald; he abstracted the vitiated air near the floor of each cell—there were 500 cells in the prison I visited—he let in the fresh air through a hole about 8 feet above the floor; the exit was through the hole in a privy. Each cell had its separate privy, down which the air of the cell was drawn. M. Hamlincourt was bound by his contract to empty the cell of its air a fixed number of times an hour; a steam engine in the cellar was constantly at work, and there was a very tall chimney to carry off the vitiated air. With such a system continuously at work, it is evident that the sanitary rules which insists on there being 600 to 1,200 cubic feet of air-space to each prisoner and to each boy in the dormitory of a school would be quite unnecessary. In a diving-bell the man has probably not more than 60 cubic feet of air around him, but the constant change of air answers the same purpose. I would much rather pass a night in a room which was 6 feet cube, and containing therefore only 216 cubic feet of air if the air were constantly but gradually changed, than in a room containing 2,000 cubic feet of air in which very slow or no change took place.

Before the "Victor Emanuel" is again employed as a hospital ship, her fittings will no doubt be carefully considered, and be altered if necessary. She has been a costly* but a most invaluable and, in the main, a thoroughly successful experimental ship. The points requiring attention are, in my opinion—

1. Vitiated bilge air to be prevented from having access through the skin to the Officers' cabins, the orlop, lower and main deck.
2. Orlop deck and holds to be supplied with fresh air by cowled tubes from the upper deck, in addition to the supply already given to the main and lower decks.
3. Holds to be fitted with stanchions and battens for establishing a clear passage to the kelson throughout the ship when possible.
4. The upper part of the holds to be ventilated as the lower and orlop deck are already ventilated, by horizontal tubes leading into the masts.
5. Arrangements to be made for supplementing the "natural" system of ventilation by "artificial" means.
6. Arrangements for preventing a down draught through the masts, when sail is set.
7. Arrangements to be made by means of dampers in the masts for stopping the ventilation instantly in case of fire and to be under

* Expense incurred would probably be—Labour, about £7,000; materials, £7,000; and time occupied, 21 weeks.

command from the upper deck, as also the supply of water to the pumps. At present the ventilation can only be stopped by sending a man to the lower-mast head to stuff a hammock or something equally suitable into the masts.

8. The space in the masts to be subdivided into three or four, thus each deck and hold would have its separate vertical chimney.
9. That as it is the tendency of most screw vessels to settle down by the stern, as coal and provisions are consumed; and all water in the ship therefore finds its way aft, the suction of the bilge pump should be lengthened sufficiently before the vessel leaves the dockyard in anticipation of this change of trim. The "Victor Emanuel" ventilation suffered for some time until the suction pipe of this pump was considerably lengthened.
10. The ventilation of screw alley should be improved by providing an escape into the mizenmast, and by cutting air holes in the roof of screw alley; also by having two air tubes (with cowls) carried from its after end to the upper deck, one for *down*, the other for *up*-draught; the holes open in the screw aperture which now distribute the foul air on the main deck and in the poop cabins, might then be closed.
11. All bulkheads of cabins and store-rooms fore and aft should have ventilating openings at top and bottom.
12. The condensing rooms require additional ventilation; this will be best obtained by direct tube connection with upper decks.

I have now presented my crude ideas on this subject to you, and I hope the discussion to follow may be useful. If it does nothing else, it will awaken attention among the Officers afloat, and when in some future war, ships on distant stations, have to be promptly prepared as hospitals, and are perfectly fitted and successfully ventilated, the Officer who superintends and directs the arrangements, will perhaps, although he may have forgotten the fact, have learnt his first lesson in ship-ventilation from the valuable paper by Dr. Macdonald, from the report of the *Lancet's* Commissioner, from the discussion this afternoon, and from the record in our *Journal* of the "Victor Emanuel's" fittings. The points for discussion, I submit, are, first, the general principles of ventilation in their application to ships; and, secondly, what, if any, are the features in the system adopted in the "Victor Emanuel" which are susceptible of improvement. I have suggested twelve.

APPENDIX.

By the courtesy of Admiral Sir W. Mends, Director-General of the Transport Department, I have been allowed to append the following official account of the ventilation of Her Majesty's Indian troop ships:—

"The plans for the ventilation of Her Majesty's Indian troop ships having been prepared chiefly in accordance with the principles known as Dr. Edmonds' system of ventilation, some explanation is considered necessary as to its general features and management, in order that those entrusted with the charge of the sanitary arrangements may understand its action and make it available—in conjunction with the

other means provided—for thoroughly ventilating all parts of the ship, especially those which will be occupied by troops or their families.

"Ordinary tube and cowl ventilators are placed wherever their action is thought desirable and space will permit. Where they are in connexion with this system of ventilation, their action is distributed through all its ramifications in the close parts of the ship. These main ventilators are five in number.

"The first and second pass up from the lower deck through the forecastle near the side of the ship. The ventilating shafts with which they are in communication are placed on each side in the angle formed by the lower deck and the ship's side: one branch passes forward as far as the prisons; the other extends aft along the fore troop deck, ventilating these parts by the air-shoots which join them and terminate in the perforated zinc openings close under the beams.

"These two ventilators are also connected with the deck air-channels over the women's compartment, the heated air from which will pass into them and up the ventilators through the circular apertures opening into it overhead.

"The third and fourth main ventilators are also lateral, and pass up near the commencement of the poop. They pass down into the after cockpit to assist in its ventilation, and of the cabins which are on each side.

"The fifth is central, placed a short distance before the mizen-mast, and passes through one of the ventilating hatches. Its action is distributed to the lower cabins, and it is also connected with the after deck-air-channels, which ventilate the central cabins of the lower saloon, through the circular apertures in the ceiling overhead. These deck-air-channels are a substitution of a longitudinal air space for the width of about a foot of the deck planks, covered in above with thick plate iron, and below with thin sheet iron, in which are the apertures. These act directly on the foul air which tends to collect between the beams and which is heated by the lights, respiration, &c.

"All these main ventilators are designed to act by the wind alone, when this is sufficient. By turning the cowls to windward fresh air will be diffused equably through their branch air-shoots, and even in calms, when the ship is going fast through the water, much air will be forced below by their action; but in hot close weather, when a more powerful ventilation is necessary, provision is made for it by means of steam jets. The circular perforated ring which may be seen in each of these ventilators is in communication with the auxiliary and main boiler of the engines. When the steam is turned on, it escapes with great force through the minute apertures of the jet-ring, and emerging from the cowl—which must be turned to leeward—carries up with it a strong current of air, which is drawn from all the ramifications of the longitudinal air-shafts and deck-channels with which the main ventilators are connected. This effect may be observed by holding the flame of a candle to any of the air openings.

"This ventilating action will be found most useful at night, when it will carry off much of the heated air arising from so many persons sleeping crowded together in a confined space, and also at meal times.

"As, owing to the length of the steam pipes connecting the ventila-

tors with the boiler, some steam must be condensed before it escapes upwards, the steam should be first turned into the pipes alone for a few minutes, and the condensed water blown through the extreme end before turning the cock which admits it into each ventilator.

"The supplemental means of ventilation on Dr. Edmonds' plans are, 1st, double-acting ventilating shafts; and, 2nd, the gunwale ventilators.

"The double-acting ventilating shafts are divided vertically into four or six divisions leading down to the lower deck. These divisions open outwardly above the deck; and one or more of them will face the wind from whatever quarter it blows, and will introduce fresh air, while the remainder will be to leeward, and by the exhaustive action of the wind, added to the upward tendency of the foul air below, its escape will be aided through these latter. Thus they have a double ventilating action, and will exert a powerful effect in renewing and purifying the atmosphere of the lower deck. The outlets below are so arranged that the influx and efflux currents will not interfere with each other. Covering doors are provided, to close the windward openings in wet or stormy weather. A half-round canvas screen may be substituted should these be carried away.

"The revolving gunwale ventilators, placed at short intervals along each side of the ship for the whole length of the gunwale, are designed to ventilate the frame of the ship and the parts into which they communicate by grated openings along the side of the main deck and cabins. Each water-closet has one of these over it, which must be used to draw up foul air, the open part of the tube above the gunwale turned *from* the wind. The others may be used either to introduce fresh air or to draw up foul air, as may be preferred. They act more strongly with the open part turned *to* the wind for forcing air downward.

"When these gunwale ventilators are in the way of ropes in working the ship, or at any other time, they should be temporarily lowered; they then offer no obstructive surface, and can incur no damage.

"As a general rule, the cowls of all ventilators should be turned *from* the wind in wet, cold, or stormy weather, using them as uptakes. In hot weather, on the contrary, every means for introducing fresh air should be made available, and their cowls should be turned *to* the wind; the heated air below will then be forced up the hatchways. In calms or very light winds, when the steam jet is used, all the cowls of the other ventilators should be turned to windward, and all ports or scuttles for the admission of external air should be left open.

"HENRY EDMONDS, M.D.,
"Staff-Surgeon, R.N.

"*6th June*, 1867."

Orders have been issued by Sir W. Mends to the Indian troop ships, that steam jets should be turned on for ten minutes at a time, not less than twice in the first watch, three times in the middle watch, once in the morning watch between Egypt and India.

The CHAIRMAN: Gentlemen, I am sure you must have listened with as much pleasure as I have done to the very admirable and exhaustive paper just read by Admiral Ryder. The subject is, I believe, one of the most important that can be brought before this Institution. I hold that it is most right and proper that some system of ventilation should go forth to the world bearing the stamp of the authority of this Institution for the instruction of Officers in command on foreign stations, as showing the best method of utilising the means at their disposal either to meet the emergencies of war or sudden epidemics, if obliged to extemporise hospital ships. It is not necessary that I should here enlarge on the importance and the value of ventilation after the full and comprehensive manner in which it has been treated. I may state, however, that having regard to the efficiency of our fleets, I look upon the maintenance of dryness between decks as only second in importance to ventilation, for with dry decks and good ventilation you will diminish your sick-lists and raise the standard of health in our ships to a wonderful degree; and in proportion as these two agents have been at work in our ships as revealed in the statistics of the health of the Navy, so in direct ratio have you had crews healthy, and ships efficient. It will be in the recollection of the distinguished Officer on my left, Sir Henry Codrington, that upwards of ten years ago, in one of our line-of-battle ships in the Mediterranean, owing to the overcrowding of the decks and the bad ventilation, very nearly one-half the ship's company were rendered utterly inefficient, and several other line-of-battle ships were in a condition but little better, and ultimately entailed their return to England; a state of things which, in time of war, might prove very disastrous. This is one of the many incidents daily occurring. I am sure you will gladly endorse all that has been said with regard to the good effects attending a sound system of ventilation, more particularly when combined with dry decks. I shall be very happy if any gentleman will favour us with a few observations on this subject, and from the number of distinguished Naval Officers whom I see in this room, the result of their experience and observation on a subject of such vast importance to the Navy cannot fail to prove valuable, and will, I am sure, go far in support of the views brought forward so ably and lucidly by the gallant Admiral, and with which I entirely concur, and I endorse the opinions expressed on a former occasion by Sir Spencer Robinson and Dr. Macdonald.

Admiral Sir HENRY CODRINGTON, K.C.B.: Was the "Victor Emanuel" painted with zinc paint or ordinary paint, because I hold it makes a great difference in a sanitary point of view, as well as in the increase of comfort?

Admiral PAYNTER: May I ask whether these openings in the deck are intended to let the foul air up, because if so, it appears to me you are letting in the foul air from all the decks below.

Captain JASPER SELWYN, R.N.: I have had some little experience on the Coast of Africa as to the benefits of ventilation, and I must say I admire very much indeed the results which have been obtained already in the "Victor Emanuel," with her well-considered fittings. I think, as Admiral Ryder has said, these may not only be improved upon for the purposes of a hospital ship, but they may also furnish us with most useful groundwork to insure thorough ventilation in all our ships. It is quite true since we got rid in a large measure of wood in the construction of our vessels, the difficulty has been considerably diminished, because those acids and those gaseous emanations constantly produced on board a ship in the course of her service are not absorbed by the wood, and do not become so difficult to treat. I commanded two steamers at different times on the Coast of Africa, and I found in one, the "Prometheus," that it was impossible to prevent the bilges becoming saturated with grease and what I take to have been sulphuretted hydrogen, in large quantities, arising from the decomposition which always goes on between vegetable substances and the water as it comes from the condensed steam. Wherever we get absolutely pure fresh water, we get one of the most subtle solvents that is known to chemists; it will attack even iron in a mode which must be seen to be believed. In the cases to which I referred on the Coast of Africa, I was unfortunate enough in both instances to have yellow fever on board; and although in one instance I landed the whole ship's company on a well chosen island, and gave them all the appliances of ventilation which could be secured, yet so long as I had to combat the malaria of the Coast it was utterly futile to expect good results. I may mention one thing

which is known to some of the Officers who were then with me, though it is perhaps rather beside the present question—I found that at certain stages of the yellow fever, particularly those where complete exhaustion threatened to bring a fatal termination, although the fever itself had been apparently overcome, the administration of the strongest vegetable food I could get, in the form of Scotch ale, invariably induced sleep and restoration of strength, while any attempt at giving strong animal foods, in the shape of jellies or broths, invariably had evil results. Of course I leave it to the medical profession to see how far they are able to explain that. The opinion we arrived at, on consideration, was, that in certain cases and forms of disease, organisms may be propagated in animal substances, while in vegetable nutriment the same organism at least cannot be further propagated. This is a useful hint for those who will have by-and-bye to treat the constantly recurring symptoms of yellow fever on the Gold Coast. With regard to the ventilation of the ship, the only method we found successful was that of taking the men on deck, putting up a double awning, and sprinkling the outside awning constantly with water. By this means a very strong current was set up, and I got very fair results. On the Brazilian Coast I again had yellow fever on board, and as I there had a very crucial experiment showing how far the fever depends on the vicinity of the coast, I will narrate it. I commanded a large brig, and was left as Senior Officer in Rio Harbour. Having yellow fever on board, I found that the bringing of the men up from the lower deck of the brig to the awning, as before described, diminished the percentage of deaths by nearly one-half. On my being relieved by an Officer commanding a large and roomy steamer, I expressed my intention of going at once off the coast to a distance of 300 miles at least, for at that distance the land breezes lose their effect, and told him that my experience had proved to me that no less distance would suffice to materially arrest the fever. He seems, however, not to have attached much importance to what I told him. I left him, and before I reached Trinidad my fever cases were doing well, and had almost disappeared; there were no fresh cases, and those who had it before I left were doing very well. By the time we got into the river at Buenos Ayres we had no further cases. My successor, on the contrary, when he was relieved in his turn, came down along the coast. The yellow fever had appeared on board his ship about ten days after I left Rio; he proceeded down the coast, and the fever never left him till he came into Buenos Ayres. Unfortunately he died, as also two-thirds of the Officers and a large proportion of the crew. My ship was by much the worst ventilated of the two, but yet I succeeded by adopting this plan; his was the best ventilated of the two, and he failed I think by adopting the reverse plan. With regard to the difficulties which may exist as to the ventilation of ships, I conceive Admiral Ryder has very correctly stated that so much difference of opinion exists among authorities as to the employment of a plenum or a vacuum that we need not expect to see our ships more thoroughly ventilated than the House of Commons. I thoroughly agree with him in thinking the process of exhaustion by the ordinary means to be found on iron ships is by far the best. That may be supplemented by exciting a more active action of exhaust rather than by attempting to force down air, which, as a highly elastic body, has very little effect at great distances. In coal mines we find a fan forcing air has not one-twentieth of the efficiency of a fan drawing air. Our masts should have been made long ago, there is no doubt, the main means of ventilating our ships, and to divide them by diaphragms, as Admiral Ryder proposes, would materially strengthen these iron masts and enable them to be made lighter. A tube is not strong unless it has some such diaphragms, which would do a great deal of good in protecting it against certain forms of collapse. In some of our ships, where we have only one mast, such as the "Devastation," such a system of diaphragms would be most useful; but as in a great many of our ships we have as many as four masts, I think Admiral Ryder will acknowledge that we could easily manage to ventilate each deck by its own mast, and so give it the full and free ventilation which belongs to the full area of the mast. With regard to the cowls and tubes connected with them, I conceive that they are to be looked at as mere iron wind-sails, which can be got up in a ship more readily sometimes than the wind-sails themselves, and more easily placed in action without unnecessary interference with the sails. With regard to the reverse current induced by the sails, that was to be expected as long as you made

your ventilating opening on the head of the mast, so exposed to a down draught, so like the top of a chimney without a cowl, and it would not be difficult to devise means by which it could be kept either out of the influence of the sails, or that it should be covered as an ordinary chimney is covered to prevent down draughts. I agree with Admiral Ryder as to the utter fallacy of expecting ventilation through the openings over the shelf-pieces in the upper part of cabins. In my experience there has been almost invariably a quarrel in wooden ships between the carpenter, who desired to keep the skin of the ship thoroughly aired, and those who did not desire foul air in their cabins. We did not like them, and we were compelled to have them. At the same time, as naval Officers, we should not forget that to attempt to leave a free communication between the upper part of the vessel for air—the bulwarks and the bilges—is not only dangerous in case of fire, unless proper means of cutting it off can be provided, but it is also dangerous in those cases where a ship heels over, and the ventilating openings become openings for the admission of water to the bottom of the ship. I hope that the subject will be still further studied, and will receive the attention which it certainly deserves from the Admiralty and the profession.

Captain the Hon. E. R. FREMANTLE, C.B., C.M.G., R.N.: It was not my intention to have taken any part in this discussion, because I did not suppose I was likely to be able to shed any very great light on this question, which is much more a medical than a naval one, viz., the ventilation of ships. But as I was obliged to be on the Gold Coast during the whole time of the last war, it may perhaps be expected that I should say a few words on this subject. As regards the "Victor Emanuel," I went on board her two or three times, but not being at Cape Coast very long after she arrived, I was not able to study the subject as fully as I should have wished, and I am very much obliged to Admiral Ryder for having brought it before the Institution. At the same time, she certainly struck me as being exceedingly well fitted in every respect, as far as I could judge from cursory observation. One thing which I heard complained of, it may be as well to draw attention to, although it may be a good deal accounted for from the peculiar nature of the service out there. It will be recollected that when Sir Garnet Wolseley first went out he took out a very large staff of Officers. The result was, there was a superabundance of Officers to white men at that particular time. The Officers accordingly, having been on the coast longer than the men, were the first to knock up, and the result was a certain amount of complaint that the "Victor Emanuel" had not been sufficiently fitted out for Officers, and had been more fitted for the men. If similar circumstances arise, and the Officers have to go out before the men do, it may be worth while to see whether this can be remedied. I will just say a few words as to the health of our ships out there. They were generally very healthy so long as they were able to move about the coast, and the men were not employed on shore. The "Druid," and "Argus," and other ships on the coast were all very healthy, so long as the men did not land. The sick list of each ship in the squadron used to average something under ten, which was very healthy for an unhealthy climate. There were very few diseases incidental to the climate at that time. When the "Rattlesnake" came up from the Cape, she was still more healthy; but then, of course, she had come from a healthy climate, and it was natural she should be healthy. Still, I think as she always had been the healthiest ship on the coast, it may be attributed very much to the extremely good system of ventilation on board that ship. After the men had been on shore some time, we always found them go down with fever. The "Druid" was the first ship that left the coast; her sick-list got up to 50. Her marines and seamen had been on shore, and she left for Ascension, and came back with her ship's company partially restored. The "Barracouta" was also very healthy a great part of the time, but when we were afterwards engaged very much at Essaman, Abracrampa, &c., the men marching up the country, especially very hard marches in the heat of the day, two of which we had, our ship's company began to go down, and I was horrified to find we had to discharge 25 men to the "Simoom" in one day. The men went down very rapidly; I fondly hoped it would have been arrested, but it was not so; we had shortly afterwards to leave the coast with something over 40 on the sick list. I had the fever myself; and although it was not of a very dangerous character, still there it was; it was increas-

ing day by day. We left the coast, went round to St. Helena and Ascension, and came back in six weeks, with only about eight on the sick list. We succeeded afterwards in keeping our sick list down tolerably, although, when we had hard work in the sun, the sickness again increased. I should also mention, that when our sickness increased in that considerable amount, not only had our men been on shore some period of time, but those who remained on board the ships had been employed by day and by night in coaling, clearing transports, and all that sort of work, which is very trying. Every medical man will no doubt agree with me that in that climate we always find any excessive exertion likely to produce fever, dysentery, or some other climatic effect. Of course we are all very careful to attend to the cleanliness of the bilges; that is a thing that by this time we all understand on board Her Majesty's ships. I am happy to say that on board my ship I adopted the plan Admiral Ryder has mentioned; it certainly was not my own idea, but it was suggested to me, and was immediately adopted. I think it would be a very good thing if it were adopted in all Her Majesty's ships. In our case, we put up capstan-bars on each side, and so were able to make a centre compartment, and to keep that cleared, and the work of clearing the hold was not the great undertaking it very often is. I always made it a point on Sundays to go round with the doctor, and to have a tumblerful of water out of the bilge. We generally found it was very sweet; and although the ship which I commanded (the "Barracouta") had had the credit of having very bad bilges on former commissions, yet we succeeded on the coast in escaping altogether any yellow fever, the fevers we had being unmistakably due to excessive exposure, and not to anything else. While on the subject of ventilation, I may state that I always had extra wind-sails; I found the ship with three wind-sails, and increased them to six. We found it very hot on the lower deck when we were condensing, and as we were obliged to condense frequently, all the water we drunk on that coast being condensed water, it was absolutely necessary to improve the ventilation of the after part of the lower deck. The old-fashioned plan of windsails was the one adopted by us, the cowls being used as up-takes. That we found the best plan we could adopt. I have spoken more particularly about my own ship the "Barracouta," but I would speak also of the other ships. They all paid equal attention to the cleanliness of the bilges and the ventilation, and I think the result, as regards Her Majesty's ships on that coast, was extremely satisfactory, considering what used to be the case in former times, when sanitary arrangements and ventilation were less understood and attended to.

Captain HOSEASON, R.N.: I would ask Admiral Ryder what part of the ventilation of the deck he proposes to stop up; does it refer to the lining of the ship?

Admiral RYDER: A block cuts it off from the bilge.

Captain HOSEASON: I remember once lending my cabin to a lady passenger, and sleeping in a side cabin of the "Inflexible," when in the middle of the night I was obliged to rush out of the cabin and call for assistance. I could not make out the cause, though I really felt as if I was dying. Taking a light, it was found that the whole of the cabin was as black as my hat. The next morning it was reported to me that every bit of my plate was nearly black, and a part of the sugar basin was absolutely unsoldered. I ordered the hands up to clear the spirit room, and when that was done we found to our astonishment hardly any bilge water at all. There was a kind of hole in the kelson which did not seem to hold more water than this hat would hold. The impression of all was that it could not be from so small a quantity of water that the gas had escaped. When, however, one of the men stirred it, we all had to rush from the hatchway immediately; it was so putrid. It only shows how dangerous it is to keep the opening that you allude to under the roof of the cabins.

Captain CURME, R.N.: I commanded one of the Indian troop-ships for three years, and have frequently carried 1,600 men, women and children. You are aware we were fitted with Dr. Edmond's system of ventilation, the "artificial exhaust" system. I habitually went round at night while the men were below, and examined the sails. The effect of turning on the steam jets was very marked. There were tubes with perforated zinc plates over them in each cabin, and at frequent intervals along the deck, and if a candle was put to them it would be blown out immediately. I was frequently accompanied by a medical officer—the thermometer showed most

remarkable results. From what I have seen, my own opinion is very decidedly in favour of the "exhaust system." If you can afford it, let it be artificial. We had a very large number of cowls; these we took care to trim so that the foremost or weather ones were "down-takes," and the after or leeward ones up-takes, but very often if it had not been for the steam jets, they would have been of little or no use. On the so-called "plenum system," if you blow a large quantity of fresh air down, after a time air must be driven from below, and the chances are even of pure air coming up with the foul. A carefully arranged exhaust must find out the impure air, and take it away. My opinion is decidedly in favour of the exhaust. In the "Repulse," we had no artificial heat, and nothing peculiar except an unusually large number of ventilating tubes with cowls—our masts were also ventilators. The men on the lower deck knew in a moment when the current was reversed, as it often was under sail. A part of our bilge was exceedingly troublesome, and nothing but the being able to get at it easily all along by an arrangement similar to that suggested by Admiral Ryder, and the excellent system of ventilation fitted by the dockyard authorities, prevented its being a dangerous nuisance.

Commander BRENT, R.N.: I should like to ask Admiral Ryder whether he has any means for taking off the foul air from the top of the men as they sleep in their hammocks. It has always seemed to me that we leave the air to accumulate over the faces of the men when sleeping, and that the effect must be injurious. As the hammocks are all placed regularly, I do not see why we should not have some pipe, whether perforated or partially open, running just over the part above their faces to exhaust the foul air that must remain up against the beams. With our ironclads cut up into compartments as they are, it would seem to me very difficult to ventilate them on the plenum system, but much more easy on the exhaust. It is, I consider, very important that we should have a means of cutting off the ventilation, for if I remember rightly, one of the great causes of the "Bombay's" loss was that the air came down what had been an up-take, and made a regular blast. That was one of the reasons why she burnt out so quickly.

Admiral RYDER: In reply to Sir Henry Codrington, I may state the paint used was zinc-paint. Admiral Paynter asked whether the cowls and tubes were shown there.

Admiral PAYNTER: I do not mean your cowls. I mean these great openings between the decks.

Admiral RYDER: Figs. 1 and 2 represent what has already been done on the upper, main and lower decks of the "Victor Emanuel." The vitiated air is carried off the main and lower decks through long horizontal iron-tubes, which have replaced two planks; on each deck there are tubes full of large holes, these of course are over the heads of the men in their hammocks, which answers Commander Brent's inquiry. The vitiated air passes up into the masts, and is carried off. The cowls and tubes bring down fresh air from the upper decks in its stead. Captain Selwyn spoke of ventilating complete decks, and doubted the necessity for having the diaphragm dividing each mast into separate chimneys. Of course the difficulty of ventilating an ironclad divided into 12 or 13 compartments is very great, and I should think it preferable to make the stack of chimneys, as I called them, as shown in Fig, 5; you would want all of them, thoroughly to ventilate the compartments. With a simple extended deck, such as we have in our open ships, I dare say the ventilation could be effected as Captain Selwyn suggests, with the simple undivided masts.

The CHAIRMAN: However much we may differ in opinion on the system of ventilation, there is one thing in which I am sure we shall all be fully agreed, and that is that the gallant Admiral is fully entitled to our most cordial thanks for his valuable and interesting paper.

Evening Meeting.

Monday, June 8th, 1874.

VICE-ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B., Vice-President, in the Chair.

NAMES of MEMBERS who joined the Institution between the 18th of May, and 8th of June, 1874.

LIFE.

McFarlan, J. W., Capt., Paymaster 5th Royal Lancers.
Saunders, E. W., Lieutenant 5th Fusiliers.

ANNUAL.

Blackett, H. W. R., Capt. 15th Hussars.
Sparshott, A. E., Lieutenant R.M.L. Infantry.
Richardson, W., C.B., Major-General late Bengal Army.
Cooper, William, Lieutenant late 4th Middlesex R.V.
White, Jervis H., Captain 77th Regt.
Eastwick, Edward B., C.B., M.P., Capt. late 6th Bombay Native Infantry.
Heyland, A. R., Captain 1st Bombay Lancers.
Hughes-Hallett, H. T., Lieutenant 57th Regiment.
Outram, A. M., Lieutenant Royal Sherwood Foresters Militia.

BREECH-LOADING AND MUZZLE-LOADING FOR GUNS.

By Major J. P. MORGAN, Royal Artillery, Assistant-Superintendent Royal Gunpowder Factory, Waltham Abbey.

THE Council of this Institution having chosen "breech-loading and "muzzle-loading for guns" as a subject on which a paper should be read, have done me the honour to request that I should give the arguments which can be advanced in favour of the respective systems. I hope, in the remarks I may offer, I may be able to aid the Council in their endeavour to disseminate information amongst the members of the Institution, without embarrassing the question with one-sided views for or against breech-loading or muzzle-loading.

To give the arguments for or against the different systems is a comparatively easy matter, but to weigh their relative values, with a view to a determination of what system affords the greatest advantages, is a more difficult matter, and one which I shall not attempt, at least so far as any adopted system is concerned, seeing that different conclusions may very fairly be drawn according to the different points of view from which the subject is regarded, and any attempt on my part to give a verdict would thus fail to meet with your approval.

It may appear to some that, in appearing before you now, I may be animated with some desire, however faint, to throw discredit on the system that has been adopted in this country. Without prejudicing the question at the outset, I think I may safely trust to your impartial judgment. My object will be to go to the root of the matter, but in thus confessing myself a radical, I trust to be able to show how much

radicalism is allied to conservatism in this matter, and how both can go hand in hand in progress towards bigger guns.

Ventilation is conducive to health, and I think the Council have done wisely in introducing this subject here, where not only zealous members can utilize the Institution as a sort of safety-valve to blow off their waste theories, but where, also, the mature conclusions of the more thoughtful can obtain the consideration they require.

Reformation retarded is revolution begun; but it is our privilege to know that we are governed by those who, in such matters, are true to the principles of our constitution, and, on the first occasion on which I had the honour to read a paper here, it was stated from the chair that both "the Minister for War" and "the First Lord of the Admiralty," who "have occupied the chair successively at our Annual General "Meetings," have acknowledged the importance of discussions here on various points connected with the two services.

These considerations encourage me to come before you on the present occasion; but what has led me to accept with gratification the invitation of the Council is the fact that I have on a former occasion proposed a new gun, which is more than all others intimately connected with the present subject, and which, in my opinion affords the only possible solution of the question to the perfect satisfaction of all parties.*

Though many others may be more competent to discuss, from a practical point of view, the question we shall have under consideration, yet, I hope to show you that the attention I have given to the principles involved, has led me to some sound conclusions which are worthy of your consideration.

The preparation of a paper to be read here has always been of the greatest benefit to myself, because it has compelled me to study minutely the matter beforehand, and the subject has invariably grown in interest and importance to my own mind in a manner that has more than recompensed me for the trouble it has involved. I heartily recommend, therefore, any member here who wishes to be instructed on any point connected with the services, not to come and listen only, but himself to undertake to read a paper on that particular subject.

The questions of breech-loading and muzzle-loading have been so sadly ill-used by the treatment they have received at the hands of their respective advocates, that I am forcibly reminded of a passage in the introduction of the "Institutes of Metaphysics," by the late Professor Ferrier, whose simple and touching eloquence I had the privilege of listening to when a student at the University of St. Andrews. He says, pp. 8 to 11:—

"§ 16. As time has advanced it has constantly sped worse and "worse with philosophy, instead of speeding better. This could not "be otherwise; to carry forward a pure science the first principles of "which are not thoroughly ascertained, and to carry it forward by other "means than that of strict demonstration is only to add layer after "layer to the winding-clothes which already cover up the truth; it is

* "Proposal for a very heavy Breech-loading Gun of Novel Construction." See Journal, vol. xiv, page 479 *et seq.*, and vol. xv, page 335.

"only to add another coating to the infinite litterings of the Augean "stable, whose pavement no son of Adam can get down to. Every "question in philosophy is the mask of another question; and all "these masking and masked questions require to be removed and laid "aside, until the ultimate but *truly first* question has been reached. "Then, but not till then, is it possible to decipher and resolve the "outside mask, and all those below it which come before us in the "first instance. Instead. however, of removing those successive "masks, each succeeding inquirer undertakes to unriddle the outer- "most one off-hand, and the consequence is that, so far from resolving "it he puts over it a new coating of paint, and thus leaves the original "masks covered over with an additional stratum of concealing visors, "by which the first difficulty of attaining to the truth is very con- "siderably augmented. So that now no question comes before the "world which does not present many disguises, both natural and "artificial, worn one above another; and these false faces are continually "increasing. . . . . .

"§ 17. But how is *that* to be accounted for? It is to be accounted "for by the circumstance that men have supposed that in philosophy "they could advance by going forwards; whereas, the truth is, they "can advance only by going in a manner backwards. We have tried "to get *to the end*, without having first got *to the beginning*. The true "state of the case is this: the world of speculation, like the physical "globe, is rounded to a sphere, but a sphere of more gigantic compass "and more difficult circumnavigation than any which the whole "universe can show. The primitive articles of all thought, the "seminal principles of all reason, the necessary constituents of all "knowledge, the keys of all truth lie at first buried under our very "feet; but, as yet, we are not privileged to find them. We must first "circumnavigate the globe; the whole world of speculation must be "traversed by our weary feet. Hence, every step forward takes us "only farther and farther from the mark. Ere long the elements of "truth—all that we are indistinctly looking for—lie in the far distant "rear, while we vainly think we behold them glimmering on the "horizon in our front. We have left them behind us, though we "know it not—like decaying camp fires, like deserted household gods. "We still keep moving onwards in a direction, which is at once "wrong and right—wrong, because every step leads us farther and "farther from the truth; right, because it is our doom. Every new "halt increases our confusion, our consternation and our dismay. Our "hearts may sink within us when we cross the line on the shoreless "sea of speculation. At the antipodes the clouds of doubt may settle "dark upon our path, and the tempests of despair may cause our "fortitude to quail; but, *vestigia nulla retrorsum*, there is no drawing "back for us now. We are embarked on an irrevocable mission; let "us press forward then—let us carry through. The intellectual, like "the physical world, is *a round;* and at the moment when the wanderer "imagines himself farthest from the house of humanity, he will find "himself at home. He has revolved to the spot of his nativity. He "is again surrounded by the old familiar things. But familiarity has

" been converted into insight; the toils of speculation have made him " strong; and the results of speculation have made him wise. He is " now privileged to dig up the keys of truth, and to see, and to show " to others, the very seeds of reason. He now beholds the great " universe of God in the light of a second illumination, which is far " purer, and far less troubled than the first. Philosophy and common " sense are reconciled."

It appears to me, that our opportunities of becoming acquainted with the difficulties of the subject have been greater in this than in any other country. We have had to buy our wisdom and to pay for it too; and though, no doubt, other countries can reap the benefit of our experience, yet I doubt if they can do so to the same extent as ourselves, for no amount of observation can ever come up to the teachings of practical experience. I cannot therefore assume, as is sometimes done, that, where there is a difference in the systems, what is English must necessarily be wrong, and what is foreign inherently right; although one thing, I think, I must assume, viz., that a breech-loading gun, provided in all respects it can be made as strong, as safe, as handy, and as efficient as a muzzle-loading gun, is at least equal and in many respects superior to a muzzle-loading gun. This is a strong point with all breech-loading advocates, and has given foreign systems an importance which they would not otherwise have possessed: but I think that the way in which the advantages, in regard to this position, are made use of is often very unfair to the advocates of muzzle-loading. Those in favour of breech-loading think, or assume, that those in favour of muzzle-loading object to breech-loading on principle, whereas they, the latter, simply maintain that all the breech-loading guns, which have ever been made, fail in one or more essential particulars to come up to muzzle-loading guns; and that, in fact, in breech-loading guns some material and important point, such as strength, safety, or other qualification has been sacrificed, so that the guns are a compromise between breech-loading and safety or efficiency, and not a solution of the difficulty. In these views, I feel that I stand on common ground with the advocates of muzzle-loading; but when they, on the other hand, wearied by the shallow and reiterated arguments of their opponents, declare that no good breech-loading gun is possible, or, if possible, must be regarded as buried for ever at the bottom of the Augean stable, I feel that I must have a word to say before such a conclusion is permanently adopted.

Breech-loading is by no means a new idea. In Colonel Owen's " Elementary Lectures on Artillery," will be found a drawing of a breech-loading gun in use in the sixteenth century, in which the charge was introduced into a removable hollow breech-piece, before being inserted in its place in the rear of the gun. The practical difficulties, however, must have been regarded as insurmountable, for we find that muzzle-loading has prevailed in this and in other countries, and the question of breech-loading seems to have been shelved until its formal reappearance in recent times.

Shortly before the Crimean War some experiments were made in this country with the Wahrendorff, and Cavalli guns, but without

much success to the cause of breech-loading. Our experience in that war, however, at the siege of Sebastopol, very greatly increased the desire for a breech-loading gun; and there can be little doubt that in siege operations, where the daily exposure of the gunners to the fire of small arms while loading the guns at the muzzle, becomes very harassing, it is felt that a breech-loading gun would be a real benefit.

Sir William Armstrong brought forward his breech-loading gun soon afterwards, and for a time many believed that he had hopefully succeeded in belling the cat; but we find, in the Armstrong and Whitworth competition, he himself seems to have doubted his breech-loaders, for he then introduced his muzzle-loading shunt system as an alternative gun. The history of our endeavours in this country to make the Armstrong system of breech-loading succeed is well known, as also the relapse to muzzle-loading, first in heavy guns, and lastly in field-guns.

Sir Joseph Whitworth in the same competition produced only muzzle-loaders, but his original gun was a breech-loader. He has again brought forward a breech-loading field gun.

On the continent, breech-loading has undoubtedly met with more success, and this is mainly due to the skill and perseverance of Mr. Krüpp, who is the sole manufacturer of the guns he has gradually brought to their present state of perfection. Prussia and Russia have adopted Krüpp guns. Austria has been undecided between breech-loading and muzzle-loading, though rather more favourable to the former. France has a breech-loader of her own which differs entirely from Krüpp's.

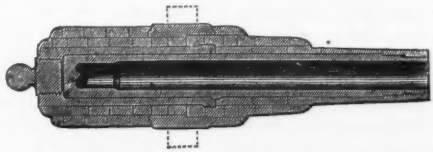
It is by no means an easy matter to get particulars of foreign guns; but a work has quite recently been published by Captain Simpson, of the United States' Navy, entitled, "Report on a Naval Mission to "Europe," which is a valuable contribution to our knowledge in this branch of the subject. A careful study of that work will amply repay any one who is interested in the question of guns; but I think there are not many in this country who will approve of the conclusions he has arrived at. Breech-loading he believes to be a real benefit, if it can be carried out. The Krüpp system of breech-loading he believes to be a success, and in order to suit it to the genius of American gun-manufacture, he recommends that Krüpp's breech-loading should be combined with Parsons' system of conversion! He does not make this recommendation as a sort of make-shift for second class guns, as we do with Palliser guns, but believes it suitable for the heaviest guns, and proceeds very learnedly to prove its superiority to all other systems. This appears to me the weak point in Captain Simpson's otherwise valuable Report. Time will not allow me to follow him in his travels through Europe in search of a perfect gun, but I may state very generally his method of arriving at the above result.

In the matter of construction, Captain Simpson is very severe on the Woolwich gun, and if any one wishes to see our faults as they appear coloured and magnified through cousinly spectacles, they will be found in the Report, turned and reproduced in a manner somewhat startling. The main argument is, that the ductility of the wrought iron is incom-

patible with the elasticity of the steel tube; and he thinks that the wrought iron must gradually expand under the continued hammering of the explosion in the bore, until at last it leaves the steel tube unsupported, and allows it to crack. He quotes in favour of this view the admitted fact, that the steel tube is the weakest part of the gun, and appeals to the Dopplemair experiments at Tegel, in 1869, in support of the idea that the Woolwich gun is inferior in strength and endurance to the Krüpp gun. The value of these experiments, he admits, has, with some good reason, been called in question by Major Majendie, "who, in a most able paper, entitled 'English Guns and "'Foreign Critics,' disputes the conclusions arrived at at Tegel by "Captain Dopplemair;" but Captain Simpson points triumphantly to a more recent experiment made by the Austrian Government in the fall of 1870 at Steinfeld, in which a 9-inch Armstrong muzzle-loader was compared directly with a Krüpp breech-loader of the same calibre. "The result was the failure of the Armstrong gun at the 111th round "by the splitting of the tube, the Krüpp gun remaining apparently as "serviceable as ever." Captain Simpson considers that "to one who "regards these failures without the feelings of a partisan, the results "must go to prove the superiority of a homogeneous built-up gun over "one which is constructed of metals differing in character." There may be much truth in Captain Simpson's deductions, but still it may be questioned whether general conclusions should be founded on such a limited amount of fact.

Krüpp's original guns were not built up, and it is only of late that he has adopted the hooped construction in all its entirety, and in this, Captain Simpson thinks, "he constantly finds himself forced to approach "to the system of building up as practised by Mr. Vavasseur," whose gun is given as an example of the most scientific form of construction.

FIG. 1. Scale $\frac{1}{48}$.



There is first a steel tube, and then a steel jacket extending to a little in front of the trunnions, and these are enclosed in a double course of steel hoops or rings. It is supposed that the hoops, being short and thin, can be better hammered, and not only made stronger but more cheaply than if in one piece. Unfortunately, however, they have frequently been found to crack during the proof of the guns, and Captain Simpson quotes "some instances of the harmless cracking of "outer hoops," as if the Vavasseur gun enjoyed the mysterious privilege of the crab—of being able, when in trouble, to part with a limb innocuously.

The value of shrinkage depends on its being properly applied; and, in gun-making, all workable theories must take into account the faults which are sure to be committed in the workshop. As a rule, no doubt, provided its capabilities are respected, the metal will accommodate itself to the duties it is called upon to perform; but it should be so arranged that any error in building up the gun will be attended with the least disadvantageous effects. Steel will stand a little over-compression, and wrought iron will stand a little over-extension, but it is unpardonable to put steel where it is liable to be put in a state of over-tension. This, then, is one of the weak points of the Vavasseur system; for, though theoretically a very good form of construction, the difficulty of adjusting the shrinkage of the outer coils is so great, that, in my opinion, it would be much better to replace them by a single strong and thick steel coil which could not have been taken in detail, or by a thick double Frazer wrought iron coil, which, instead of "harmlessly cracking," would have yielded by virtue of its ductility.

These short steel rings also give no longitudinal strength; and though it is claimed that the jacket is sufficient for this purpose, yet it will be observed that insufficient longitudinal strength is acknowledged by the fact that the powder chamber is of less diameter than the rest of the bore. Now it is admitted on all hands that, instead of diminishing the diameter of the powder-chamber, we ought rather to increase it; and this alone would be a fatal objection to the Vavasseur system for very heavy guns firing heavy charges.

Captain Simpson's commendation of the Vavasseur gun loses, I think, much of its weight by the way in which he introduces it as paving the way for the Parsons' gun, which he thinks differs only from the Vavasseur gun by having the outer rings replaced by cast iron. "There is nothing like leather;" and Captain Simpson proceeds to establish the foregone conclusion that cast iron is better suited than either wrought iron or steel for the outer casting. Wrought-iron, he thinks, is too ductile, and steel too elastic, for the position where elasticity is not required, but that in cast iron "there is a happy mean between "these two contradictory systems which admits of the steel developing "sufficient elasticity to impart strength to the structure, and in which "this same elasticity is controlled at a point which is judicious and "safe." Unfortunately for the argument, cast iron is deficient in the very two qualifications which are necessary to produce so very desirable results. Its elastic stretch is much greater, and not less, than that of steel, while its want of strength or ductility in either case render it little suited to control or yield to the expansion of the tube.

As with the Vavasseur gun, Captain Simpson professes to found his arguments on the results of proof with the Parsons' gun; but in this case also he finds it necessary to offer some apologetic remarks.

Were it not that I have denied myself the privilege of making invidious comparisons, I might, by retracing Captain Simpson's steps, very plausibly argue from the greater endurance of the Woolwich guns, that the Woolwich gun being superior to the Parsons' gun, which

is superior to the Vavasseur gun, which is superior to the Krüpp gun, must necessarily be the very best gun in the world.

The failures of Krüpp guns have been numerous and often fatal to those who worked them. The late Major Haig, R.A., in a paper on rifled heavy guns, gives a list of more than twenty steel guns, mostly Krüpp, which have burst explosively, killing and wounding seventeen men;* and Colonel Reilly, C.B., writing last year, says,† "We have reports of the bursting of an 11-inch (Krüpp) "gun last year at Cronstadt; two more are reported to have burst "in Russia this year; and a 15-centimetre gun burst at Tegel "in the beginning of last December." Captain Simpson attributes these failures to the want of the steel hoops which Mr. Krüpp has since adopted in his more recent constructions; but surely, in all fairness, if the Krüpp system is allowed to progress and have all its previous failures ignored, the same charitable consideration should be extended to the Woolwich gun, and any accidental weakness, which may be due to exceptional brittleness in the limited amount of steel employed, should not be put down to a fundamental error of construction. Nor should the fact be ignored, or but lightly passed over, that the amount of ductile wrought iron, which is used in the construction of the Woolwich gun, has hitherto resulted in an amount of safety with which no other gun can compare. The great strength of steel is acknowledged, but its want of uniformity and of ductility have as yet

* "Of the danger and uncertainty of steel we have ample evidence, both in this "and other countries, and it must be borne in mind that the failure of steel in "small guns is an *à fortiori* argument against its use in large guns. And secondly, "that these failures have occurred in a comparatively insignificant experience of "steel ordnance.

"In June, 1860, a puddled-steel 12-pr., made by the Mersey Steel and Iron Works, "burst at Shoeburyness at the sixth round.

"In June, 1861, a 7-inch steel gun by the same makers burst at the sixteenth "round; while in November of the same year a 20-pr. Krüpp gun burst at the "second round.

"In March, 1862, a French 30-pr. steel gun burst at Gavres.

"In August, 1865, a Krüpp 9¾-inch steel gun burst with a moderate charge of "powder, a Prussian Committee attributing the failure to inferiority of the metal. "In Russia, during the same year, a 9½-inch gun of Krüpp's steel burst at the "sixty-sixth round, and an 8½-inch similar gun burst at the ninety-sixth round.

"In June or July, 1866, a 9-inch Krüpp gun burst in Russia at the fifty-sixth "round: while in the same year a field-gun by the same maker burst at Berlin, "killing three cadets.

"During the Prussian campaign against Austria in 1866, six Prussian steel field "guns burst.

"In January, 1867, a 7-inch Krüpp gun burst at the second round of proof at "Woolwich; and in the same year a 4-pr. burst at Tegel, near Berlin, killing two "men.

"In 1868, an 8-inch Krüpp gun burst on board a Russian frigate very destruc- "tively, killing and wounding in all twelve men.

"In 1869 (January 27th), a similar gun burst in Prussia into twenty pieces.

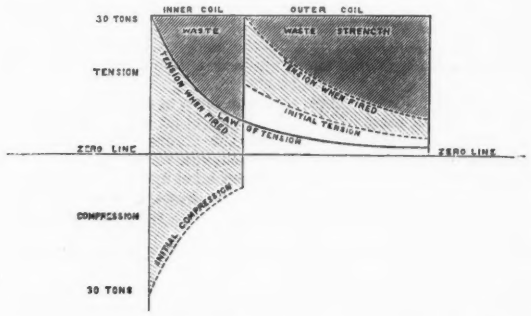
"Besides these guns, large guns constructed of steel, supplied either by Krüpp "or Petin and Gaudet, have burst violently at Madrid and Turin."—"Proceedings "Royal Artillery Institution," vol. vi, p. 471, 1870. "Rifled Heavy Guns," by Captain Haig, R.A., F.R.S.

† "Notes of a Visit to Berlin," 1873, p. 25.

rendered it, so far as we know, liable to bursts of the most violent description. Krüpp may have overcome this tendency by his having at last, through bitter experience, resorted to shrinkage, but, to say the least, it is only judicious to wait the results of a larger experience before coming finally to the conclusion that such is the case.

As has been stated, Captain Simpson considers Krüpp's most recent hooped construction to be of the same type as the Vavasseur, differing only in the thickness of the inner tube, which is about three times as thick. In order to compare theoretically the effect of this difference, it is necessary to bear in mind the effect of shrinkage. I have explained this very fully in a previous paper, and I may here state that the utmost possible gain that can be obtained by shrinkage is to double the strength which would be given by the same material without shrinkage. This is done by compressing the bore to its utmost limits, so that the expansion during firing, instead of being from rest to extreme tension, is from extreme compression to extreme tension, or double as much; and so, according to the law of strength and Hooker's law of "*ut tensio sic vis*," the strength is doubled. Provided this is done, it is of little consequence how many coils are used, as far as theory is concerned, so long as no part is unduly strained by over tension or over compression; and that this can be done by two coils of steel, the inner of which is half calibre and the outer one calibre thick, is shown by the accompanying figure, where the thicknesses of the coils are given on the abscissa, and the ordinates upwards represent the tension and those downwards the compression.

FIG. 2.



The dark portions represent the loss of strength, and the faintly shaded portions the stretch and strength called into play by the explosion of the powder in the bore.

If the elastic limits of steel be taken as 30 tons, both for tension and compression, this construction would have an elastic strength equal to 45 tons of pressure per square inch in the bore, whereas without initial tension the same metal in one piece would be equal to only $22\frac{1}{2}$ tons.

It the outer coil be made in two pieces, the inner coil may be made even thicker, without theoretical loss, as in the case of the Krüpp gun, which has a tube $\frac{3}{4}$ calibre thick, but there is no theoretical gain by dividing the inner coil, unless the outer half be made of harder steel, so as to give more strength with less stretch. This latter would indeed be an advantage, but in the Vavasseur gun it is not made of harder but of softer steel, for what reason I know not.

Though it appears to me, from a practical point of view, that the greatest mistake Krüpp has ever made is in not having a thin inner tube of softer steel than the rest of the gun, yet these considerations show that theoretically, with homogeneous steel he loses nothing, in point of strength, by having a thick steel tube, provided the outer hoops are strong enough to compress it. And, when we come to a consideration of the question of breech-loading, we see that this is an important advantage. The Vavasseur gun having a doubtful character for longitudinal strength, even as a muzzle-loader, would find that character hopelessly gone if converted into a breech-loader, by slotting a hole for the breech-closing apparatus through the most vital part of the gun. The Parsons' gun would be even weaker in this respect, and Captain Simpson does not even give us a hint of how he proposes this arrangement to be carried out. Krüpp's idea, however, seems to be, to have first plenty of strength, and he then proceeds fearlessly to reduce it for the sake of breech-loading, just as Whitworth also makes a very strong gun and then proceeds to strain it unmercifully by using a very small bore and a peculiarly dangerous and rapid twist. In the Woolwich gun, it is preferred not to make the gun unnecessarily strong, but at the same time not to reduce the strength given to it or to strain it unduly.

Those who advocate breech-loading must in fairness be expected to say how it is to be carried out, and whether it is a wrought iron or a steel gun they propose in the first instance. If steel be recommended, it is to be remembered that it is only after long experience that Krüpp has brought its manufacture to its present state of perfection; which is said to be a secret of which we are as ignorant as we are of the still profounder mysteries of Whitworth metal.

Since writing this, I have had the advantage of an explanation from Sir Joseph himself, as to his steel, and I must confess it is a revelation to me. It appears that the brittleness and want of uniformity of steel are not due, as I have always supposed, to the uneven distribution of the carbon and to uneven tempering, but to the fact that bubbles of air are enclosed in the metal. Sir Joseph says that these air bubbles cannot be sealed up by hammering, but by his method of compression of 20 tons to the square-inch they can be eliminated, if the pressure is applied within five minutes after casting. He thus finds steel to be a reliably ductile material, and that the ductility is inversely as the strength; if this be so, and it can be produced economically, as Sir Joseph Whitworth says it can: any remarks I make against steel do not apply to Whitworth metal, for, as he observes, if we have ductility in steel with twice as much strength, it must undoubtedly be better than wrought iron.

When a comparison is made between the Krüpp and Woolwich guns, the great amount of steel used in the former must be taken into account; as it is unfair to contrast a gun having a thick steel tube with one having a thin steel tube, when we are considering construction only. This naturally leads to the conclusion that, in the Woolwich gun, the tube is too thin for the greatest possible strength.]

Practically, the experience of the Gun Factories is in favour of soft and thin steel tubes; but this may be a manufacturing point of consideration, and not a theoretical one. Both points might be met by the use of a steel breech-piece, and this I pointed out on a former occasion. As the case now stands, the steel tube has to perform two functions demanding entirely opposite qualities. It has to resist initial compression, and at the same time develop the greatest amount of elasticity; but, if the compression were received by a hard steel breech-piece, the tube could be made as soft as necessary; and, I have no doubt, if this were done, the Woolwich gun would be very much increased in strength. As at present constructed, the Woolwich gun has an elastic strength of about 25 tons, and I think this fact is sufficient to account for the failure of the steel tubes under the combined action of exceptionally high pressures and brittleness of steel, while under ordinary conditions the endurance is very great, without assuming as Captain Simpson does, that there is something radically wrong in the principle of construction.

Krüpp's system of breech-loading is identical with the Armstrong system in respect of weakening the gun by slotting a hole close to the seat of the charge. This will be seen in the accompanying figure (Fig. 3), where the wedge is shown in position ready for firing, and fitted with the Broadwell ring or gas check. The method of keeping the wedge in its place is by a screw, which is plain on one side, so that a half turn allows the wedge to be withdrawn.

FIG. 3. Scale $\frac{1}{24}$.

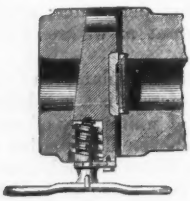
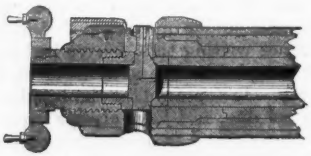


FIG. 4. Scale $\frac{1}{38}$.

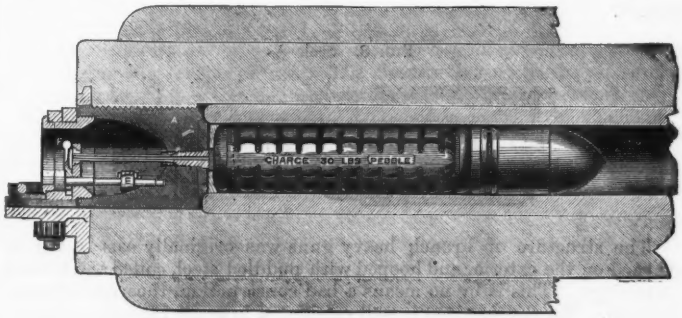


It is to be remembered that the strength of a tube is much increased by having the metal continued in both directions beyond the area on which the powder-pressure acts. Cutting the slot, however, terminates the strength close to the powder chamber, and the benefit of the projecting metal is entirely lost. It is for this reason that Armstrong's heaviest breech-loaders had all to be strengthened by an extra coil just over the powder chamber as shown in fig. 4 which represents a 7-inch gun.

The mere matter of whether the piece of metal which closes the bore be held in its place by a screw or by a wedge is of secondary importance, so far as the strength of the gun is concerned, however much it may affect the safety of the breech-closing arrangement itself. As, therefore, Armstrong's arrangment has not been proved to be successful with his own construction for the heaviest guns, it is by no means certain that Krüpp's system of breech-loading would be suitable with the Woolwich gun.

There is, however, another system of breech-loading which has been adopted in France, and which has been applied by Sir W. G. Armstrong and Co. in an improved form, experimentally, to one of their 7-inch guns, which differs from the original Armstrong and Krüpp systems in the important respect that it cuts no slot in the side of the gun, and therefore does not necessarily weaken the structure of the gun, at least circumferentially. The following drawings of the "French modified" breech-loading system, have been furnished to me by Mr. Rendel, the partner who specially presides over the Gun Department in the firm of Sir W. G. Armstrong and Co.

FIG. 5. Scale $\frac{1}{10}$.



It will be observed that the bore is carried right through to the rear, and a part is enlarged to receive a screw plug which closes the end of the bore, very much after the manner of a muzzle-loader. As, however, it would be impossible on each discharge to unscrew this piece of metal without great waste of time, half of each thread is cut away in three portions so that the threads are not continuous, either on the plug or in the breech of the gun. In inserting the plug, the threads correspond with the cut-away portions in the breech, and when home, a small turn brings the threads into bearing and the gun is ready for firing.

Figures 6 and 7 are end views of this gun, the former shows the gun in the position for loading, with the loading tube in position, and the latter in the firing position, with the vent uncovered. A sliding

bracket is provided to carry the breech-screw and loading-tube, and is worked by a lever to alter it into the different positions.

FIG. 6. Scale $\frac{1}{10}$. FIG. 7.

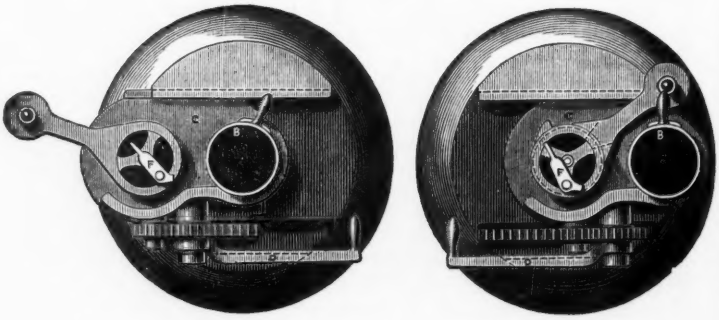
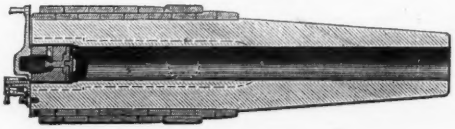


Fig. 8 is the French breech-loading gun from which the idea is borrowed.

FIG. 8. Scale $\frac{1}{30}$.



The structure of French heavy guns was originally cast iron guns turned on the exterior and hooped with puddled steel, coiled and welded into rings. This is by no means a bad construction, theoretically considered. For the cast iron is well calculated to resist the initial tension of the steel hoops, and its elasticity allows of a considerable amount of expansion during firing, and thus increases the tension of the less-elastic steel hoops. The metal which gives the greatest amount of elastic expansion should always be next the bore, provided its other qualities are equally suitable, and it is an undoubted advantage to have the metal as rigid as possible at a distance from the bore. In these ideas I agree with Captain Simpson, but I draw exactly the opposite conclusion, because I believe he is under a mistake as to the qualities of cast iron, and I think that if cast iron is to be used on the exterior, wrought iron, or at least ductile steel, should be used for the bore; but it may be more advantageously placed in the interior with steel hoops on the exterior, *provided the shrinkage can be properly effected.*

In France a steel tube has of late been added to this construction, extending from the breech to a little in front of the trunnions, and of

increased diameter and thickness at the breech to receive the breech-screw. I am not disposed to think very highly of this construction, because of the smaller amount of elastic stretch of the steel next the bore. It is highly probable that the cast iron will add little or nothing to the strength, and had better be removed, unless indeed it should so happen that it acts as a sort of elastic buffer between the steel of the bore and that of the exterior, and thus helps them better to accommodate themselves to each other. In my opinion the less cast iron in the walls of a gun, the better; and, for this reason, I am inclined to think that the Krüpp construction is very much superior to the French. It is different, however, with the breech-loading; and there I am inclined to think the French has the advantage, because it does not weaken the structure of the gun. The only way in which it is weaker than a muzzle-loading gun is the fact that it has only half the amount of thread-bearing surface in the plug, while at the same time it receives more thrust, because the tube cannot of course be made solid-ended. There is a difference of opinion as to the advantage or disadvantage of an open end with regard to circumferential strength. For my own opinion I am inclined to think the gun is thereby strengthened, because the bore is relieved of a cross strain. The strength of a piece of metal may not be affected in either direction by a cross strain, but the stretch undoubtedly must be, and it is the amount of the stretch of the bore which calls into play the tension in the exterior coils.

There is also a difference between the two systems in the methods of preventing the escape of gas. The Broadwell ring used by Krüpp is shown in fig. 9, and the wad used with the Armstrong "French modified" gun is shown in fig. 10.

FIG. 9. Scale $\frac{1}{14}$.

FIG. 10. Scale $\frac{1}{25}$.

It will be seen that the recess for the Broadwell ring cuts into the metal of the bore and necessarily increases the area on which the longitudinal pressure acts, but in the "French modified" this is entirely avoided. The Broadwell ring also depends for its efficiency on the accurate fitting of two metal surfaces, and has to be used again and again, but the "French modified" has a paper wad covered with copper or gun metal, which can accommodate itself more readily, and can be renewed each round. I have seen the "French modified" gun fired more than once, and occasionally double shotted, and there was no escape of gas whatever. Moreover, it did not blow out its breech-plug, though I confess to a certain amount of fear lest such should be the case. The original Armstrong guns used to strip the threads of the breech screws, which fault, however, was remedied by an alteration in the

shape of the threads; whether these guns can be made equally safe in this respect would be a matter for experience to determine. Mr. Rendel is quite confident that they can.

It will be observed that there is an arrangement by which the gun cannot be fired until everything is safely in its place. Some similar contrivance is to be found in all breech-loaders, manifesting a conciousness of the terrible consequences which would ensue if everything were not properly secured. Even if no serious accident should happen, the fear of danger must always, to some extent, diminish the confidence of the gunners, which is so very necessary for the efficient working of the guns. I well remember the dread I felt of Armstrong guns, on the first occasion it was my duty to fire them on a field day, when the General commanding galloped down the line shouting, "Are those breech-pieces screwed up?" Of course, knowing the haste with which guns are usually served, no one can be certain that such is always the case. It is here, I think, that the advocates of muzzle-loaders hold an all but impregnable position, for even with all the safe-guards that can be applied by the greatest mechanical skill and foresight, they may confidently point to the safety of their system, and say, in the words of Mr. Disraeli's brilliant epigram, "I can baffle the open "attacks of my enemies, but who can cope with the unconscious machi-"nations of stupidity."

I have had no experience of the working of Krüpp guns, and can only refer you to the published opinions of two eminent authorities speaking under a sense of the responsibility which attaches to their positions as advisers of their respective Governments, Captain Simpson and Colonel Reilly, who differ considerably on this point.

Captain Simpson says:—

"The *safety* of the breech-loading system is considered to be fully "established by the experience of the late war with France. During the "whole campaign there has occurred but one accident with a field gun, "and that is known to be due to neglect in closing the wedge tightly "before firing.

"The *endurance* of the guns has been remarkable, many of the field "guns having reached to two or three thousand discharges.—Report, "&c., vol. ii, p. 63."

Colonel Reilly says, with regard to his observation of the working of heavy breech-loading 26, 28, 17, and 15 centimetre Krüpp guns at Madgeburg:—

"The result of this day's practice was to my mind a complete answer "to the first argument in favour of breech-loading guns, viz., the facility "of loading and firing; the guns were worked by well-instructed men "who are continuously employed in the establishment, we, therefore, "saw the breech-loading tried under the most favourable circumstances. "The operation of loading appeared to be laborious, complicated, and, "if not carefully performed, dangerous to the gun, and I should con-"ceive, consequently, much slower than that of loading a muzzle-"loading gun; whilst, notwithstanding the care bestowed upon the "closing of the breech, an escape of gas, was at times observable. But "as my own experience is limited to one day's fire it will be well to

"quote the opinion of an Officer,* given in a Report, otherwise favour-
"able to Mr. Krüpp's system.

"He says:—

"'Krüpp's cylindro-prismatical wedge with Broadwell ring, the
"'best breech apparatus known up to the present time, requires for its
"'manufacture uncommon mechanical appliances and great technical
"'skill.

"'Before every part of it is right and works well enough for
"'service, a great deal of trouble is required, and very little is enough
"'to disable it intentionally or involuntarily for present use. The
"'wedge, the ring, the gas escape-plate of one breech-piece and gun,
"'cannot at once be used for another gun, so that only under certain
"'supposition would it be of any use to take duplicates of these and
"'other parts of the breech-apparatus, for the purpose of serving
"'several guns in common.

"'Some of the parts, especially the Broadwell ring, are subject to
"'the weakness of losing immediately, by rough handling, those
"'properties without which they do not act.

"'To keep the breech-piece in order in such a way that it may at all
"'times be used without any delay, renders compulsory many precau-
"'tions in the daily cleaning, especially as regards the material, of
"'polishing, and preserving; and demands, at least on the part of
"'the captain of the gun, the knowledge of how to put the apparatus
"'together.

"'On board ship, more than anywhere else, on account of the
"'damp, it is difficult to prevent the rusting of the surfaces which are
"'to be kept bright, and uninterrupted attention must be paid to the
"'gun from this cause alone; but where there is a great deal of
"'scouring there is a good deal of wear.

"'In the event of the Broadwell ring not closing the breech par-
"'ticularly well, both the ring and the plate must be wiped clean
"'after every shot, which is not easy to do where the wedge is in the
"'position for loading, and can therefore only be done imperfectly.
"'In such a case it will be more frequently necessary to bring out
"'the wedge to the end of the groove, but this will involve a loss
"'of time, which time may possibly be invaluable. . . . . .

"'Although only three movements are necessary to open, and as
"'many to close, the possibility is not excluded of one of these move-
"'ments being forgotten in the heat of battle. If this oversight
"'occurred in closing—we mean an omission in pushing to the locking-
"'bolt the breech would not be closed; on discharge, the gas would
"'rush violently out, the respective surfaces would be so fouled that
"'they would require a thorough cleaning, and, which would be the
"'worst part of the matter, this oversight might possibly lead to the
"'breech-piece being blown out, which would be equivalent to putting
"'the gun *hors de combat*.'"†

With regard to endurance in action, Colonel Reilly says:—"During

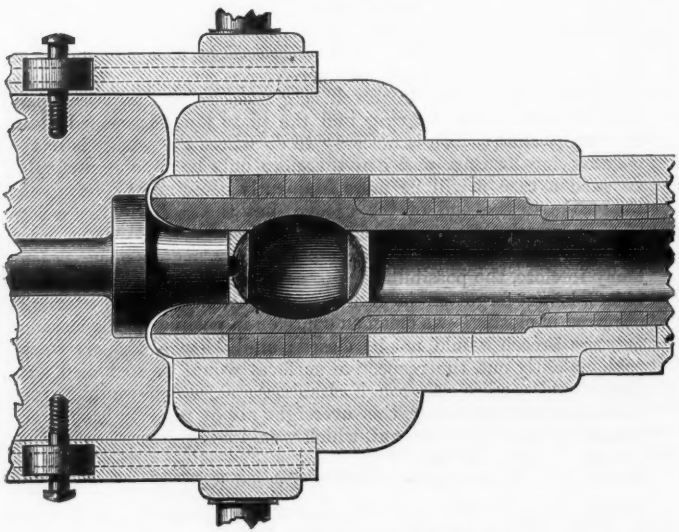
* Lieutenant-Colonel Wilhelmi, the Imperial Royal Austrian Marine Ordnance Corps. "Archiv. für Seewesen Mouchard," May, 1868.

† "Notes of a Visit to Berlin, 1873," p. 18.

"the last campaign many guns became unserviceable from their own "fire. I believe it is correct to state that twenty-three guns became "unserviceable in the army of Prince Frederick Charles before Orleans, "in the three days' fighting, the difficulties of the breech-loading being "aggravated by the severity of the weather—two guns are known to "have burst. The return given by General Walker, the Military "Attaché at Berlin, of guns damaged during the compaign, shows a "total of 165, most of them by wearing of the breech-piece."*

Thus far I think it appears undeniable that, other things being equal, muzzle-loading guns are superior to breech-loading guns, in the three important qualifications of strength, safety, and cheapness. There is, however, a system of breech-loading which, though not in operation, I have advocated in this Institution as eminently suited to heavy guns, and which not only gives even greater advantages than muzzle-loading guns as regards strength, but which, in my opinion, is also calculated to solve nearly all the most difficult questions connected with heavy guns. I have stated the advantages of its construction in a previous paper, and the method of its action has since been successfully demonstrated in a firing model. The principle consists in receiving the longitudinal pressure on a heavy and solid block of metal, not rigidly connected with the rest of the gun, so that not only is there no cross strain on the bore, but we are free to adopt the strongest form of construction for the rest of the gun. I advocated wrought iron, steel, and

FIG. 11. Scale $\frac{1}{16}$.



* "Notes of a Visit to Berlin, 1873," p. 34.

wrought iron as probably the best form of construction, but as wrought iron would scarcely withstand the stress of the powder in the bore, it might be modified to soft steel for the bore and harder steel in the next course, as shown in the accompanying woodcut, so as to act both for compression and tension by a smaller amount of stretch, and which could safely be made, if thought necessary, of short hoops, the same as employed by Mr. Vavasseur. It is here, and not at the bore itself, that I would fight out the battle of strength, and allow the remaining portions of the metal, both within and without, to find a sort of backbone to which they could accommodate themselves. It is, I think, because the Palliser guns are made on this principle that they have shown such remarkable endurance in comparison with the weak character of the metal employed, and, if the same principle be carried out with better material, the result must be very great strength. The soft steel would accommodate itself to the harder and thicker steel behind it, as the wrought iron accommodates itself to the cast iron in the Palliser gun. The outside coils could be made of anything most suitable; either one thick Frazer coil or two Frazer coils, or one course of soft steel hoops and a Frazer coil. The elastic strength would be thus between 50 and 60 tons.

If Whitworth metal be found to come up to Sir Joseph's anticipations, it will be possible to improve the Woolwich construction till no wrought iron remains. I do, however, beg that the outside coil may be a *thick Frazer coil* of whatever material may be found most advantageous.

This gun agrees with the French gun in closing the breech by a solid plug or piston, but differs from it in the manner in which it resists the longitudinal pressure. Instead of being kept in its place by the tenacity of the threads of the screw, it is kept in position by the mass of metal behind it. This is a most important difference. Tenacity is a quality that is limited in amount and liable to failure under repeated strains of great amount; but, like time and space, the resistance of mass can be calculated upon with certainty at all times. When tenacity fails there is violent explosion, but the resistance of mass increases as the pressure increases, and it is practically impossible to move a heavy mass in a very short time. If the breech is not screwed up with the French gun, the results are disastrous; and if any one wishes to see the effects of the explosion of even 50 lbs. of powder, he has only to come to Waltham Abbey, and see the photographs of some of the mills which have been blown up. No screwing up of the breech, however, is required with this gun; nor can the breech ever get jammed, because the result of the explosion is to open it harmlessly after the shot has left the bore; neither is there any difficulty in closing it, because by releasing the compression, the breech runs up into its place under the action of gravity. In this manner advantage is taken of the forces ready at hand, and no inconvenience arises, however big the gun may be. The Armstrong gun became unwieldy because of the weight of the breech-piece, which had to be lifted in and out of its place every round, but here no such difficulty occurs.

Much more, however, has to be considered besides strength and

workability in this or any other breech-loading gun, and I shall now address myself to a few of these considerations.

The first and most fatal objection is the lead-coating on the projectiles, which has hitherto been used with Armstrong and Krüpp breech-loading guns. It gives great friction, and Colonel Reilly very justly points out that, though Krüpp guns give higher velocities than Woolwich guns owing to their greater length and more perfect combustion of the charge, yet the penetration obtained from them is less, owing to the lead-coating flying off on impact. In a paper read here on rifling, I referred to this, but proposed a system which I thought would remedy it.*

The French system of rifling for breech-loading guns was originally the same as the Woolwich, but there is a difficulty of insuring with this system and breech-loading guns that the shot shall not go beyond its position in loading, which does not occur with muzzle-loading guns, because with the latter the shot is rammed home till it is stopped by the cartridge. In order to obviate this, and remedy other defects, a new system of poly-grooved rifling has been adopted in France, and the body of the projectile is encircled by two or more soft copper rings, which take the grooves in the same way as lead-coating. This, however, I imagine will only be found a more expensive compromise, for even if it be strong enough to give rotation to very heavy projectiles, there must still be very much friction.

The escape of gas at the breech is another consideration; but experiment has shown, both with the "French modified" and with my firing model, that this can readily be met.

We next come to windage and fuze, which it will be best to consider together. Here the advantages seem to be divided. Windage is bad for scoring, but windage is good because it allows of the use of a good muzzle-loading time fuze. Percussion fuzes are mainly used in Prussia with their breech-loading guns, but I am confident that no gun will ever be accepted in this country which does not allow of a safe muzzle-loading time fuze. This was the secret of the Dartmoor experiments, and, the Armstrong gun, though very successful, was secretly handicapped by the conviction that, even though it might succeed with good and new time fuzes which were ignited by a percussion arrangement, there could be no security that it would not one day fail. The following extract very fairly shows the general feeling on this point.

Extract from the Quarterly Report of Proceedings of the Department of the Director-General of Ordnance. Vol. VIII, p. 110.

"10 | 5 | 70. Minute 27,957.

"Colonel Adye to Controller-in-Chief, 5th April, 1870, states, that "it is admitted on all sides, that the fuzes of the breech-loading field "guns are in a very unsatisfactory state. The question is a serious "one, as our field artillery is thereby rendered in a measure, unfit to "take the field.

* "Rifling for Heavy Guns." See Journal, vol. xvii, page 648, *et seq.*

"These fuzes have apparently two incurable defects:—1st. From "their mechanical construction they are apt to go off prematurely and "spontaneously from travelling and jolting; and 2ndly, they deterio- "rate rapidly from chemical action and damp, in which case they "become blind. They have also other minor defects.

"Notwithstanding the great efforts which have been made to over- "come the two chief defects; our condition is worse now than at "first. The reports of defects and failures are becoming more "numerous and serious, and the service generally is in confusion from "the variety of patterns.

"Some steps must be taken at once to remedy this state of affairs. "Were the defective condition of the fuzes the only point requiring "consideration, he would recommend a Special Fuze Committee, as "suggested by Major-General Lefroy; but in reality this is only one "part of a great question—the condition of our breech-loading field "artillery generally.

"It has been apparent for some time past to those who have studied "the question, that the breech-loading system itself has broken down, "not only as regards the ammunition but also as regards the guns.

"In his opinion, it is not desirable to enter into discussion, or to "make further experiments with fuzes for breech-loading guns, when, "by considering the general question, it is probable that of fuzes will "solve itself.

"He therefore recommends that the question of fuzes be not "referred to the Council of Ordnance at present."

We have always prided ourselves on our Shrapnel shells, and very justly so. That shell, however, requires for its efficient working a good time fuze, and, though a percussion fuze has found favour in Prussia, on account of its much greater simplicity, I can say, on the authority of Colonel C. Chesney, R.E., an eminent authority on such a point—that, though the Prussian percussion fuzes acted very well when firing down into the basin of Sedan, they failed almost entirely when firing up-hill at Gravelotte, passing harmlessly over the heads of the French troops. The nature of the country makes little or no difference with Shrapnel shell and good time fuzes properly set, and the skill and steadiness which has always been found in English troops, makes the combination eminently a national one.

An effectual method of solving this difficulty in favour of breech-loaders was jointly proposed by myself and Captain Nolan, R.A., in 1870. This was by passing a tube through the body of the shell by which the flash of the charge could pass through and ignite the fuze, as shown in the accompanying figure.

FIG. 12. Scale $\frac{1}{12}$.

A 12-pounder Armstrong breech-loading gun was used and the action was perfect. Out of six common shells fired, five acted perfectly

and one burst at the muzzle. As it was usual for one in six of these shells to burst at the muzzle this did not affect the question.

Length of gun is another consideration, and here undoubtedly the breech-loader has the advantage, on account of the greater velocity and accuracy of shooting which can be obtained with a long gun. It is not very easy to give exactly the increase of velocity which results from increase of length, because it depends on a variety of considerations.

Captain Simpson gives tables with Krüpp 28 to 33 centimetre guns, which show about 25 feet for each calibre, from 18 to 22 calibres. I may here observe, that it is a very inaccurate method of comparing the lengths of rifled guns by their calibres; and that designating the lengths of bores by the number of expansions of the charge, as employed by Captain Simpson, is much more scientific. To say with smooth bore guns that they were so many calibres long was sufficiently accurate, because the weights of charge and shot were always in proportion; but with rifled guns, which not only differ in this respect very greatly from smooth bore guns, but even among themselves, to speak in this manner is very misleading. A 68-pounder gun has about the same length of bore as our 8-inch rifled gun, and is consequently the same length in calibres, but, as the chargé of the latter is double that of the former, the number of expansions with an 8-inch gun is only half of what it is with a 68-pounder.

The longer the gun, however, the greater is the difficulty of loading it at the muzzle. This question has been taken up by Sir W. G. Armstrong and Co., who have invented a plan of loading by hydraulics, which can be applied in ships outside the turrets, by depressing the muzzle of the gun and using a flexible rammer. That that eminent firm should be able to overcome this or any other mechanical difficulty, does not at all surprise me, because I know that in Mr. Rendel, their gun department is presided over by an engineer who is second to none in England.

This cannot, however, in my opinion, be regarded as a direct solution of the problem, but rather a method of turning the difficulty by a flank movement. And, if it is to be carried out, the question naturally occurs, why have a turret at all, whose main use will be to save the gun and not the gunners? Its dependence also on the efficient working of the hydraulic rammer, and on the turning of the turret to a loading position each round, the machinery of both of which may get out of order, gives it no little complication.

Another method of solving the difficulty in favour of muzzle-loading guns, is the Moncrieff system of dipping the gun, so that, no matter what be its length, it can be loaded by men under cover. Even that plan, however, involves difficulties with very long guns where long rammers have to be used, for the rammer must either be made in pieces or be flexible.

There are, however, some eminent artillerists who maintain that the question of protection is not a vital one, and some very good reasons can be urged in favour of this view. In the same manner as coats of mail were thrown aside on the introduction of small arms, so might we

dispense with defensive turrets in our ships of war, and trust to the greater increase of offensive power. It would also be undoubtedly a great misfortune if a confidence of safety should encourage our armour-clads to rush rashly, on the old plan, to close quarters, where they would be brought within the dangerous region of torpedoes; and, if our muzzle-loading guns, and the necessary exposure they involve, will conduce to make our seamen see that their greatest advantage is to fight the enemy at long ranges, and will thereby develop to the utmost, the natural skill and steadiness which our nation inherits, and which has always been our greatest safeguard, I for one shall be thankful that our muzzle-loading guns have produced so great a benefit; for after all, it is on our men and not on our material, that we must mainly rely.

The same may be said to be the case with field guns, for though a breech-loading field gun, with a small steel shield, as proposed and worked out by Sir W. G. Armstrong and Co., would be a great advantage at close quarters in a defensive position, in the great majority of cases the place of artillery will be found to be at long ranges, and its offensive must also be its defensive power. Such an arrangement, however, if it can be conveniently worked out, should not be despised.

Chambering is a point not to be overlooked. All our experience goes to prove that not only shall we get the greatest initial velocity with a chambered gun, but that we shall avoid the very destructive wave-pressures which are mainly due to the great lengths of cartridge with rifled guns, while, in addition, with a breech-loader we should then be able to ignite the charge through the breech-closing arrangement without encountering the loss of velocity and intensified wave-pressures which result under a similar arrangement at present, and thus obtain greater facilities for renewing the vent.

Chambering, however, should not be applied to heavy guns as is the case with the Martini-Henry rifle, where an enlarged area is given for the action of the powder-pressure longitudinally. This with heavy guns would be very detrimental. I have thought of applying it, as shown in Fig. 11, with my gun, where the reduction of the thickness of the tube would not inconvenience the longitudinal strain.

The reason why I would diminish the size of the bore in rear of the charge would be in order not to accumulate an inconvenient amount of *vis viva* in the breech, and thus necessitate greater weight. The chamber could be filled with an expanding cartridge as with a muzzle-loading gun; but I think it would be better to insert the cartridge in

FIG. 13. Scale $\frac{1}{30}$. FIG. 14.

two pieces, as shown in Fig. 13, and it *might* thus be possible to use with advantage different descriptions of powder without mixing them.

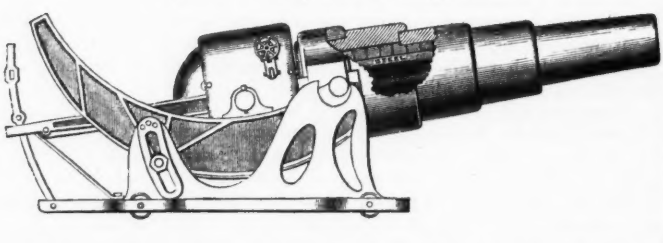
The outer cartridge would have to be inserted somewhat as shown in Fig. 14.

Up to this point I have considered qualities many of which are shared in common by my gun with either muzzle-loaders or breech-loaders, but which no other gun can combine. There are some other artillery questions, the solutions of which have hitherto been attended with great difficulty, but which my gun readily solves.

Muzzle-pivotting has never succeeded, because the centre of gravity of the whole mass of the gun has to be raised. The only way in which it can satisfactorily be accomplished is by the Moncrieff principle, or some such modification. With my gun, however, the trunnions have merely to be fixed in the turret and the whole question is solved.

Another point is the shock of discharge which, with high elevations and very heavy guns, strains the carriages and platforms enormously. Even with the Moncrieff system there is always the downward shock. With my gun, however, there is positively no shock whatever of any description. The breech slips away perfectly parallel to the bearing surface, and there is not even a chance of disturbing the elevation. The greatest strain with a 1,200-pounder gun would not exceed 100 tons, instead of being at least 1,000 tons with any other system, firing at 15° elevation. This is evident by an inspection of the model, of which Fig. 15 is an exact representation.

FIG. 15. Scale $\frac{1}{8}$ of Model and $\frac{1}{96}$ of Gun.



All these points become of vast importance when the size of the gun becomes very great. And, as stated in a previous paper here, it was with this view that I brought forward my gun four years ago. At that time, however, many met me with the objection that so large a gun was not required. Events, however, have fully justified my anticipations, for we find that now a gun even bigger than the one I proposed has been ordered. Whether it will stand or not, remains to be proved. On the present system two points militate against its endurance. In the first place the pressure of the gunpowder increases as the size of the gun increases, for we find that with field guns the pressure is from 10 to 12 tons; with the 8-inch gun it is nearly 20 tons, and it is anticipated that with the 35-ton gun it will be difficult to keep the pressure under 25 tons. So that what the pressure will be with the 81-ton gun is a fair object for speculation, and I am not sanguine

that it can be put at less than 30 tons, even if it can be put as low as that, without loss of efficiency. There is theoretically no absolute necessity for this increase of pressure, but practically it is found to be the case, probably on account of the larger charges and the greater development of heat.

The other point which militates against the present system is the deterioration of fibre which occurs when large masses of iron are subjected to high and long-continued heat, more especially when this process has to be repeated after cooling, as will have to be done in the case of the 81-ton gun. It was for these two reasons that in a previous paper I limited the capabilities of the Woolwich gun to a 1,000 pr. When I read that paper, however, I did not calculate on the skill and experience which have since been obtained by the Committee on Explosives, and which will undoubtedly be brought to bear in providing a more suitable powder for this monster gun. The two questions will, as they ought to, go hand in hand, and the Committee will, no doubt, take care that the gun is not unduly strained. It may therefore be objected that the great strength provided in my gun will thereby be rendered unnecessary; but it ought not to be forgotten that these guns are not intended to be used in time of peace, when everything can be scientifically and suitably adapted to them, but that in all probability they will be used in a great war, when powder will be obtained hurry-scurry and with no certainty that it is equal to present requirements. Powder, unless carefully watched in manufacture, has always a tendency to manifest very violent explosive qualities, and it is well to be prepared for every emergency; and it is also to be remembered that not only is a violent powder much cheaper and more readily manufactured, but that every effort to reduce the violence of the explosion has to be compensated for by an increase in the weight of the charge, if we are at the same time to maintain the efficiency of the gun. In addition, a most important point is, that strength of gun can always, as a rule, be utilized in giving increased velocity, and that penetration does not increase as the velocity merely, but as the square of the velocity. Though we have great strength, we need not always use it, and there can be no doubt that it would be a great safeguard against the splitting of the tubes which Woolwich guns are occasionally liable to, and which Captain Simpson very justly points out, renders for a time the gun *hors de combat*. Such an accident would be a serious misfortune if it occurred in a large ship carrying only two very large guns.

These are my views as deduced from theory which I venture to put before you. If you think them too theoretical, my apology is that I have not had the opportunity of testing them as others have, but I have already had some experience of the fact that really sound theory will never be found to fail in practice,

Artillery, of late, has received a very great development, but, I believe it is still capable of being developed to an extent that will astonish even its most ardent admirers. The adaptation of hydraulics to the loading of guns is a very great step, and will be found as efficient with breech-loading as with muzzle-loading guns. I am

much pleased that Sir W. G. Armstrong and Co. have succeeded in applying it to muzzle-loading guns; and that what may be called the principle of loading round a corner has been established. It is the very thing that is wanted in order to remove the last possible objection which can be taken to my gun, for it has often been urged that the breech would be in the way in loading. A flexible rammer would obviate this. By using hydraulics also to run up the breech, the working would be very much simplified. Its action, however, is not made dependent on hydraulics, but on the explosion in the bore and on gravity, which can always be depended on.

In what I have suggested, I trust that no one has drawn the conclusion that I am so unpatriotic as to suggest that our English guns are inferior to those of any other country. If such were the case, I would not suggest so many remedies and a new system of breech-loading. I have plodded my weary way as well as I can, and I trust that I have shown you, that I have deeply studied the subject, not merely with a view to this paper, but long, patiently, and experimentally as far as I have had opportunities of so doing. The Armstrong system taught us the difficulties of the subject; and though we have gone on learning in this difficult question, we can never say that it has been settled till we have succeeded in producing a satisfactory breech-loading gun. I, for one, cannot as yet say that this has been satisfactorily accomplished. With regard to my own gun, though there are some besides myself who believe in the perfect soundness of the principle, and many more who would like to see it tried, it has as yet failed to receive the recognition which is necessary to demonstrate the principle on a large scale. I cannot complain that this is the case. The principle is so novel that one is more inclined to look upon it, as it has been called, "one of the "eccentricities of genius," than as a serious proposal. It took me 15 years to believe in it and work it out; I cannot complain if others take as long or a little longer.

I may conclude this paper by referring you to some remarks by Mr. Mallet, C.E., F.R.S., in a discussion on a paper, before referred to, on "a proposal for a very heavy breech-loading gun of novel con- "struction," in which I first introduced my gun to the notice of the public, which, to some extent, have given a tone to the observations I have made, and which have always appeared to me unequalled for their masterly appreciation of the whole circumstances connected with breech-loading and muzzle-loading.

A MEMBER: How much powder have you fired in that model, and was there any escape?

Major MORGAN: Two ounces, and twelve ounces of shot. It was fired at Elswick, Mr. Rendel looked at it, and he admitted that there was no escape whatever.

Captain NOLAN, R.A., M.P.: I should like to ask the lecturer a question, although I fear that it is not exactly a fair question; as I have often tried to solve it for myself and have not been able to do so. I should like to know, is there any continental power at the present moment, that has determined for the future to have muzzle-loading guns?

Major MORGAN: I know of no great power.

Captain NOLAN: Could you mention the largest?

Major MORGAN: I know Norway has the muzzle-loading Armstrong. As a rule,

those countries that get their guns in this country, take the guns we have. Those who stand by the English Government, the Egyptians, the Turkish Government, the Norwegians, all have had Armstrong guns. I am not a good authority on that point, but with the little experience I have, it is what I say.

Colonel CHESNEY, R.E.: It seems to me, that the question of breech-loading and muzzle-loading guns is unfortunately unnecessarily complicated by the persistent habit of confusing the heavy navy or fortress gun with the totally different instrument which the field gun really is. The two are not to be compared in their scientific characters. The result of that confusion is this: German Officers are perfectly and entirely satisfied that breech-loading is the system; but they adopt that view entirely from the experience of the late and previous war. Their experience is an experience of field or siege guns. As far as it goes they are perfectly satisfied, but we have not the slightest proof of any real importance that the breech-loading system can be, according to present experience, applied to very heavy guns under constant firing. The confidence I repeat, that the German Officers have in their guns is essentially as field guns. Those who remember how sanguine people were in this country about breech-loading guns for the Navy, and how utterly that confidence disappeared when the said breech-loading guns were tried, chiefly in Japan, will appreciate my meaning. One might even go with the German Officers, and agree that the breech-loading field gun does everything that can be required of that particular instrument, and yet it is possible to have no belief whatever in the use of breech-loading guns for a heavy fortress, or for naval war. I may add, that being employed on a Government mission in France and Germany very shortly after the war, I took the opportunity of looking up that question of the 23 guns that failed in Prince Frederick Charles' Army before Orleans, I met the particular Officer of Artillery to whom it fell to repair the guns; and he told me it was quite true that there were 23 guns temporarily disabled, but that they were all very easily and very cheaply repaired, and that the cost of repairing in no case exceeded thirty shillings. That seems to be a fact worth knowing. But the one point I wish to put strongly before the meeting, is that it does not follow that because the Germans have had what they fairly consider an immense success with their field guns, that the same system would succeed when you come to the enormous weights which Herr Krüpp is now carrying into his manufacture of heavy cannon.

Colonel GORDON, R.A.: Colonel Chesney has shown us one error that we may have fallen into in considering the question of breech- and muzzle-loading ordnance, but I think there is another which ought to be guarded against. Major Morgan read extracts from a report made by the Director of Artillery connected with the experiments carried on at Dartmoor, which spoke in a very condemnatory manner of breech-loaders, but I think it ought to be taken into consideration, that these were merely experiments with one particular system of breech-loading, which was the first introduced or the first brought prominently before the Government, and that perhaps some other systems are superior to it now. Therefore, because reports from Dartmoor state that it failed in that instance, I do not think we should condemn breech-loading entirely. With regard to the fuzes, the same argument may be used. It is true of the old (E) time-fuzes, that the experiments were carried on with, that they were liable to deteriorate by being kept, and also liable to go off in the limber-boxes, but we have a very good breech-loading time fuze now, which acts very well. The time-fuzes are very little used with any of our heavy guns; they have been withdrawn from all common shells, and are issued in very small proportion for our Shrapnel for ships. I think we might have an efficient fuze for breech-loading for the purposes which are required. The Prussians, I believe, do not use them at all.

Captain OWEN, R.A.: Sir, we have all heard that a large number,—I may say a very large number,—of the breech-loading field-guns with Prince Frederick Charles' Army were rendered unservicable during the short campaign in France. Colonel Chesney has just informed us that the average cost of repairing these guns did not exceed thirty shillings. The expense seems to me of little importance comparatively, provided the guns were for the time *hors de combat*. I would wish, therefore, to ask Colonel Chesney whether the guns in question were capable of repair in the field, or whether it was not necessary to send them for that purpose to an arsenal?

Colonel CHESNEY: There is no doubt their place had to be supplied; or rather that they had to be sent back to the depôt some considerable distance, an artillery depôt made in France. It is fully admitted that they were disabled for use in the field.

Major STONEY, R.A.: Sir, the Prussians were no doubt very successful in the last campaign. Everything is rose colour now in the Prussian system, everything is all right. Had their campaign been a failure, they would have laid the blame perhaps on the breech-loading guns; but I cannot admit that because the Prussians are satisfied with their campaign, and because they overcame the wretchedly manned artillery of France, that for that reason breech-loading is the proper system for field artillery. We ourselves have made very large and expensive experiments. Sir Joseph Whitworth knows we commenced trying some of his muzzle-loading guns, and Sir W. Armstrong's muzzle-loading guns against Sir W. Armstrong's breech-loading guns, and the result of that long and costly experiment, which cost £30,000, was that the balance of advantage lay with the muzzle-loading guns, and that muzzle-loading guns could be loaded with "perfect ease and abundant rapidity." After that there was a practical Committee of thirteen Artillery Officers of high rank, and they had to judge of the question for field artillery, and came to the same conclusion, and consequently, we have slowly and no doubt wisely, adopted muzzle-loading guns for our field service. But, as Colonel Chesney very properly remarks, there are two distinct questions, and it does not follow, even though breech-loading should be admitted for field service, that it would be at all adapted for heavy artillery, in which strength and simplicity are more to be desired than rapidity of fire. Major Morgan fires two ounces of powder from his model, but he cannot judge from that how such a gun fired with 150 lbs. of powder would answer. His idea is clever, but I do not understand how he can count upon its proper action in practice. He says that the breech-piece comes back to the loading position with perfect ease; it is so beautifully managed, that the shot goes out and the breech-piece comes back, and everything is all right, and nice, and quiet. But from our knowledge of gunpowder we cannot presume on these things. We cannot say that Major Morgan will be able to make a big gun, fired with an enormous charge, from which the shot will advance with sufficient energy and the breech-piece retreat with perfect mildness. It might be *vice versâ*; for example, should the breech-piece move before the shot which has to take the rifling leaves the bore, there would be a great escape of powder-gas, and the pressure on the shot would be so enfeebled thereby, that it would leave the gun with a low initial velocity, and it would be comparatively worthless against armour plates. We all know how cautiously we have proceeded with the service guns. We proceeded step by step. We commenced with the 3-pounders, went on to the 6, 9, and 12-pounders; then to 20, 40, 60, 64, 70-pounders; 7-inch, 8-inch, 9-inch, 10-inch, 11-inch; 35 tons, 38 tons, and now there is an 81-ton gun proposed. We have excellent guns accordingly, and I do not see what useful purpose it serves to try and find out faults of waste of strength which no doubt they may have, and to propose to supersede them by a novel system which is only represented by a model which has fired two ounces of powder.

Captain NOLAN: I should like to ask Major Morgan, would the powder have time to get away? The breech-piece being so much heavier would move so very slowly back. I do not think the breech-piece would have time to get away before the powder could get out. The powder would not have time to get out between the rear part of the gun and the breech-piece before the shot had left the bore.

Major MORGAN: I have been so wearied with this objection that the only thing I can say is that guns, like everything else, must obey the multiplication table, and I am prepared to prove by the multiplication table that the shot will be out of the bore before the breech opens. I admit the loss of pressure of one per cent., but I am prepared to give 15 to 20 per cent. more of initial velocity, and by increasing the pressure in the bore by 30 per cent., which can readily be done owing to the strength of the gun, I can surely afford a discount of one per cent., and still be a gainer of 29 per cent. I have given my gun as the strongest possible form of construction, and have never recommended it till the necessity arose for a very heavy gun. If Major Stoney objects to it as a big gun; then, I say, that is the very thing I propose it for. I have been so wearied with similar objections that I have almost felt irritated

at times. Some have said the shot will drop harmlessly out of the muzzle and all the danger will be from the escape of the powder behind. I have said in reply, only make a gun and stand in front when it is fired, and I will stand behind.

Captain SCOTT, R.N.: It is extremely difficult to speak on so wide a subject without full consideration of the matter, and I confess I entirely forgot that Major Morgan's paper was to be read till Saturday afternoon, consequently I have had no time to look thoroughly into the question, and hence can only make a few general remarks. It is perfectly true, as Colonel Chesney has said, that granting that breech-loading has succeeded with field-guns, that is no reason for its succeeding with the far larger heavy naval guns; in fact Major Morgan has shown that powder-pressures increase so largely in proportion as the charges are increased that breech-loading might even be a perfect success with the one, and yet fail entirely with the other. With respect, however, to heavy breech-loading ordnance having been successful in the Prussian ships, I can affirm that the Officers are not at all pleased with their breech-loading guns, and would very much prefer muzzle-loaders. The people that have used these breech-loaders when I talked quietly to them, admitted that there was always an escape of gas, that these guns took longer in loading than muzzle-loaders, and that the fouling caused a stiffness of working which interfered with closing the breech, and tended to strain the apparatus. In time of war they, therefore, feared they would find great difficulties in working breech-loaders. One of the principal Prussian Naval Officers, when over here, was exceedingly anxious to get one or two of our 18-ton guns for the purpose of testing them against the Prussian breech-loading gun, believing that if they were obtained from our Government Gun Factories such guns, would prove superior to the Prussian breech-loading gun. Our Government would not grant the guns and so the thing fell through. The arguments which have been so ably advanced to-night as to breech-loading against muzzle-loading, would certainly not have been listened to with such interest had there not been grave doubts as to what the value of our naval gun really is. If our muzzle-loaders were perfectly successful, there would be no place for breech-loaders, but it is because our muzzle-loaders are not perfectly successful and very few people deem them perfectly successful, that the arguments so well stated by Major Morgan have been so attentively listened to. Our position is, that we have been continuously experimenting from the time the muzzle-loaders were introduced up to the present moment. What then are these continuous experiments due to? Major Morgan has given reasons for the adoption of an improved construction, and he thinks a different rifling with an iron or even a lead-coated shot would be an advantage. Without going into the details of construction, one thing appears on the surface which is, that the large wrought iron coils of our present guns are better adapted to resist the blows of heavy shot than guns built up of small pieces, and certainly far better than any combination of cast iron. That better guns may be made hereafter with steel, if that admirable metal of Sir Joseph Whitworth's be as successful on a large scale as it is admitted to be so far as tested, there is little doubt. For naval warfare we want the strongest gun we can possibly get because it is of the greatest importance to obtain the highest initial velocity, and it is precisely in initial velocity that our present guns are deficient. Our gun system has been condemned by the Indian Committee, and now the Prussian and Austrian authorities have, in a measure, condemned it. What is this due to? I do not believe it is due to the construction. I believe it to be entirely due to the faulty rifling and the very weak projectile fired from it. At the moment a Naval Officer was lecturing in this Institution and showing these and other defects in our gun system, and proving that the failure of our guns did not occur in the powder-chamber but in the shot-chamber, at that very time a report had been written by the President of the Indian Committee in which he used similar arguments; and pointed out that the want of endurance of our guns was really due to the faulty system of rifling. He traced out the hammering that the gun suffered from the shot in its passage through the bore, and the consequent rapid destruction of the gun. We all know that continuous hammering would destroy even the strongest structure, but besides this result from the defects in the Woolwich system of rifling, there is another, namely, the rapid erosion or eating away of the upper surface of the bore. The hammering already mentioned is clearly proved from its effect upon the erosion, for when a gun after

having been very much fissured by the escape of gas over the shot is turned round and re-vented on the opposite side, the hammering in a very short time knocks down all the deep scoring or erosion; in fact, calenders at the bottom part of the bore quite smooth. The erosion of the bore in the large guns seems to be quite as destructive if not more so than the hammering of their shot. One of our largest guns which was recently fired in a very slow and careful manner, stood only 140 rounds (it could not safely fire more); and had then to be turned round and re-vented. This rapid deterioration is due to the faulty system of rifling and projectile already adverted to, and which allows a large escape of gas through deep wide grooves with only two or three studs to check it. Practically, then, we are not yet beyond the experimental stage; indeed, we are now told that it is essential to use some means for checking this escape of gas and consequent erosion of the bore in order to preserve the lives of our guns. At the present time a series of experiments with very heavy copper rings or discs is being carried on at Shoeburyness in order to obviate this fatal defect which becomes more and more fatal as the gun increases in size. We see at once what we should come to in a naval action with such appliances, for what ship could safely support another ship which was firing copper-ringed shot, for the rings would go in one direction and the shot in another? If the rings were attached to the base of the shot their weight would then assist to break up the projectile, which is already so weak that many believe we must come to a steel projectile. The ultimate conclusion respecting the use of the copper discs as gas-checks appears to be not to use them in peace time, but only use them in warfare. But not only will every shot have a different range, but a thing which cannot be practised with in peace can never be efficiently used in war. The subject of naval ordnance is, however, a very great question, and many considerations are involved. Hence what we really want is a careful inquiry into the whole subject, at once to look all the difficulties in the face and honestly to address ourselves to putting the matter right. If this be done, England will, as she ought to do, still keep in the van of mechanical development, and continue to make capital guns, and have them rifled and be able to use them, far better than any other nation in the world.

Admiral RYDER: With regard to escape of gas in the rear of a breech-loading gun, I saw on board a large French ship when the guns were cleared for quarters, leather shields on the trigger lines of the breech-loaders. I was informed that the fire was so excessive occasionally, that the men's clothes were set on fire, and this shield on the trigger line was to protect the men from the back-fire. No accuracy of practice could be expected under such circumstances. I think I understood the lecturer to say the Russians still obtain their guns from Krüpp, but I believe that, although they have their guns made on Krüpp's system, they manufacture them themselves.

Captain SELWYN, R.N.: I am like Captain Scott, in very great difficulty as to the wide extent of the paper and the impossibility of discussing, with anything like fairness, the number of subjects brought forward in it, which deserve indeed almost another paper to be written in order to answer them. But there are one or two points which I think we may usefully consider, and among the first is the vexed question of breech- and muzzle-loading, whether for field artillery or for naval guns. What are the advantages we propose to ourselves, first in the field guns, from breech-loading? Is it rapidity of firing? Is it increased protection? Or, if not either of these, what is the other advantage we expect to obtain? If it is rapidity of firing, it would be well to consider that by no possibility can you move, even although you have separate men for each purpose, shot, powder, wedge, and breech-ring, in the same time that you can move the shot and powder alone forced home by the rammer, because in all muzzle-loading guns in field artillery, it is a very common practice in rapid work to put the powder and shot in together, and let them go home with one blow, as time is an element of rapidity; and we have never yet seen in a fair contest between breech- and muzzle-loaders, by equally trained men, that the muzzle-loaders have been behind. I doubt that breech-loaders give increased rapidity. Increased protection to the men? Increased protection to the men is a result which if not effected by the smoke, I am quite certain will never be by the gun. If the gun is fired as rapidly as a muzzle-loader can be fired in action, I am quite certain, particularly if you resort to slow-burning powder, you will have quite

as much smoke as will protect the men against anything but chance shot, and that they will have to wait after firing for that smoke to clear away and stand round the gun in their usual positions. Now, let us take the case of heavier artillery. Where is the increased rapidity of fire there? You have got enormously increased weight in the masses to be moved; it involves considerably increased difficulties, such as those that Admiral Ryder has so well pointed out just now. It is all very well to fit surfaces in a factory as you wish them to be always; but you cannot get it retained in practice, just as you cannot get a level platform for guns at sea which are devised for a level platform alone. If we had a level platform there are a great many things which would be possible at sea which we have not got and cannot have. You cannot get the advantage of greater rapidity in the heavy gun any more than you can in the field gun, for, while in all breech-loading guns the number of movements remains the same, the weights to be lifted and replaced are largely increased. Increased protection to the men is certainly not to be derived from any consideration that they are standing behind the breech of the gun rather than by the side of it, since shot will come in every direction, and nobody can tell exactly which man may be struck. I confess I doubt now, as I always have doubted for the last fifteen years, that there was any increased value to be got from breech-loading in any form whatever, although I do not see that the most simple systems have yet been adopted. I know it is quite possible to close the cylinder from the rear by another cylinder divided into three wedges, so that while it will resist the impact of the powder firing shot out, it will not resist a child's touch to draw it out. That is quite possible, and it does not cut the gun's cylinder across at all. But I do not believe even so you can avoid this difficult question of moving increased masses beyond those of the powder and shot itself. You cannot get the increased rapidity in any case. Then we ought further to consider, as the Woolwich guns formed a great part of the paper, how far the construction there is in accordance with the correct principles of physics. I utterly and totally deny, though I am in the presence of great engineers who can correct me if I am wrong, that the best substance to support compression, is anything but cast-iron. I say distinctly, that the more crystalline the structure the better, if you wish to resist compression, and I say also, that if you require to resist the blow of powder you must have a hard substance, and not a ductile one, in the ordinary sense of the term; that the thinnest possible hard skin of steel in the interior of a gun is sufficient to resist a blow and transmit it, exactly as the skin of the anvil is sufficient to transmit its blow; that then, the substance most fitted to receive and distribute that impact is a crystalline substance; the substance most fitted to restrain these crystals in place, externally, is that which has the greatest tensile strength, and which may be as ductile as is consistent with this tensile strength. There the Americans have gone a-head of us in trying how far they could improve cast iron—which we admit to be a bad metal if applied where tensile strength or great hardness is required—by slow cooling and a variety of arrangements, by which they render the whole structure more radially strong than it could ever be as a simple mass of cast iron. They have shown us the way in that, and we have only to carry it further as we get better metal. The best steel is only thoroughly good iron. As we get better metal we have only to carry the tempering process still further, and we can then arrive at cast guns, and not built-up guns. To cut metal to pieces and put it together again can never be equal to homogeneity, provided that homogeneity is well understood to mean the arrangement of the parts in such a way as that they will resist strain. I do not say homogeneity, understood so as that the substance shall be homogeneous in the arrangement of its fibres and crystals all through, is good, any more than an ordinary cast shot would be good as against a Palliser shot. Sir William Palliser has arranged the metal to resist the strain brought upon it, and he has given us a good result as far as it went. As regards the point brought forward of the uncertainty of fuze, I really think it deserves much more comment than it has yet received. It is a subject in itself thoroughly deserving of a whole night's discussion, for if our artillerists, whether at sea or on ships, cannot rely on the shells they fire doing execution at the right time, it is quite certain we shall get gradually to disparage shells altogether, and to rely on single shot, which will not do much more, against uncovered men in the field at least, however big those shot may be. If the question which has been brought

forward of a gun firing its own breech off, be proper to be discussed, I certainly, for one, should not be willing to discuss it on the principle of the diminution of range due to the recession of the breech, since that is only comparable with the recession of the whole gun under recoil. The tube in an entire gun recedes necessarily as the shot goes out, and in proportion as the mass of the gun is greater than the mass of the shot. In Major Morgan's gun the rear end of the tube is made more massive and effects the same result. But I do say, that to try a gas escape with two ounces or ten ounces of powder gives us no reliable comparison whatever when we come to work with the larger guns, that it would be necessary to be very careful in proceeding in that trial, and I, for one, should be very slow to be convinced, particularly as we have seen, from what Admiral Ryder has said, that the ordinary breech-loading gun carefully secured gives still serious gas escape; but there is another difficulty to be noticed, and that is that the parts of a small model, though carefully arranged as to comparative weights, can yet never give comparative friction, and when you have got to deal with that gun on a movable platform at sea, you would have still greater difficulties to contend with. I do not think it can ever replace the system which Major Moncrieff is bringing forward, as giving us security for the men. I always have believed that that was the true and right system to follow, that it would enable us to put our guns under water, and eventually, when we are sufficiently instructed in the art, to do away with armour altogether. Therefore I am not willing to accept it as any modification which would come in the place of the Moncrieff system. The subject I feel most interest in, as an evident advance, is that our artillerists have at last become convinced that the rifling they have had and praised during many years, is not a good rifling. I think that is a decided advance; such an admission is at least an approach to what we long desired in this Institution. We want to see a fair trial given to true engineering principles. We do not want to see short bearings; we do not want to see mixtures of metal. We want to see a shot which may be handled in any sort of way you like, and which, if the ship is seriously disturbed by heeling over, will bear knocking one against the other without being so bruised as to impede loading; and we want a shot which, instead of destroying the guns by rattling about in it as it comes out, will take a steady long bearing, and for this purpose I have seen nothing from the day I first saw them in the first Exhibition in Hyde Park, like the long bearings of Captain Scott's shot. There is nothing so well adapted to rough surfaces and which has shown itself so capable of keeping the guns free from injury; there is nothing, also, which diminishes so little the strength of the gun, and which allows of so thin a tube to be used—if a thin steel tube be a desideratum—allows so thin a steel tube to be used, and yet accomplishes the turning of the shot by it. If we can get a well-balanced shot, not giving inordinately powder pressures at certain times to destroy the interior of the gun, I think we shall be able to revert to a powder which does not give us a great deal of smoke, of which a great part does not blow out unburnt, and which does not involve the necessity of having a different description of powder for each different nature of gun, or of lengthening guns till they will no longer go into the turrets, in order to consume the slow-burning powder.

The CHAIRMAN: As Major Morgan says that there is nothing to answer, I have nothing more to do than to thank him for his very carefully prepared paper.

Carthaginians
Romans
Hannibals Tower
H
W
W
W
Passignano
NOTE I appears to be Torre
C " " Colline
C.G.N.
OLD ROAD
MODERN ROAD
L A K E T H R A S I M E N E
Island
Sanguinetto
Borghetto
Ambush
Guadamdra
R
C

J. Jobbins

NOTE ON THE BATTLE OF THRASYMENE.*

By the late Lieutenant-General Sir CHARLES J. NAPIER, G.C.B.
Communicated by his Nephew, C. G. NAPIER, Esq., C.E.

I IMAGINE that the road in the time of Hannibal passed over the hills at *R*, crossed the Sanguinetto, and again passed some lesser heights (which project towards the marsh) at *P*, which spot I consider to have been the *centre of Hannibal's position*. I think that the marsh came much higher than at present, crossing the line of the present road, and reaching the old road which there is (at this day) in this direction. It is marked in the sketch. I traced it as far as the Sanguinetto from Passignano, and even to the village of *Collina* (see *C* on plan), but I had not time to go up to that village and from thence over the "Gualandra" to seek for traces of a road that, at the moment, I was not aware of the value of, in the consideration of the subject. Supposing, then, that my conjecture is correct, the army of Flaminius would have crossed the first branch of the Gualandra at *R*. The Consul would have imagined that Hannibal was waiting for him at the strong pass of Passignano, *M M M M*, as an ordinary General would probably have done. It is a position of great strength. On reaching the pass at *R* he was not likely to have seen Hannibal's position, because (Livy says) he marched before daybreak through the pass, and not expecting his enemy in advance of Passignano, made no reconnaissance of the ground *short* of that position. The position at *Toro* was not (in the mind of Flaminius) brought into comparison with that of Passignano, nor did it deserve to be under less skilful combinations of genius. All this was natural, and it is very probable that the reckless Consul intended to occupy Toro (*T* on plan) with his own forces, while he advanced in the middle of the day to reconnoitre the enemy posted at Passignano. When day broke, he had probably passed the village of Collina, and the light armed Carthagenian troops in ambush, closed behind him and followed up his rear in silence. His advance guard coming at once upon the pass *between Toro and the great ridge of hills*, and supposing it to be the enemy's advanced guard, would (as Livy says they did) attack the pass, and probably at first carry it; for Hannibal, having posted his main body here, his right resting on the *Gualandra*, his left on *Toro*, would naturally encourage the success of the Consul's advance guard, to entice the main battle more close to his position, and as all the ground about Toro is covered with wood, he could show or conceal just as much of his force as he thought proper (and it is said that all the low ground was

* This note can only pretend to be a rough conjecture, formed on the ground, and had never been revised or reconsidered; its value, therefore, depends on the military qualities of the distinguished Officer who made it.—ED.

enveloped in fog), as the cavalry of his army could act effectually on the level ground of the valley on Flaminius's right flank and rear, chopping him off from the passes of the hills he had just crossed, and, as it were, giving the hands to the light troops now in the Consul's rear at Collina, quite surround the Romans. Hannibal, no doubt, placed them somewhere about the spot I have shown on the sketch. In this state the battle began; 6,000 Romans cut through the Carthagenians, and reached a hill; that hill I conceive to have been the one marked *N*, because, 1st, it is probable that when Hannibal exhibited his troops in position at *Toro*, and the Roman advance was engaged, the *leading* troops speedily formed, being in some degree *prepared* by seeing the Carthagenians appear; 2ndly, as the position of Toro is low, these Romans would try to gain the higher ground at *G;* 3rdly, the ground is less rugged apparently on this slope, and, unconscious of the trap in which they were caught, a bold legionary chief would seize this height in hopes of turning the enemy's flank, leaving those who followed, to deal with him in front; 4thly, as they were cut off, and from their position saw the whole state of the battle, and being probably sharply pursued, they naturally would get upon the hill at *N*, and be able to hold their ground for a while.

Let us return to the main body now attacked in front by the main Army of the Africans, in the rear from Collina, on the left by the troops rushing down from the hills on that flank; and on the right by the cavalry.

The banks of the stream are *marshy*—the horse would therefore keep at some distance slaying the fugitives as they sought the hills in rear. In this state, the rivulet appeared the safest place to men in terror, seeing the horsemen did not approach it; along it then they crowded naturally, and there fell by the hands of the pursuing infantry, till the lake and marsh arrested further flight. Here Livy says they tried to swim across. I observed an island about half a mile or more from the shore. In their desperation they no doubt tried to reach this. Panic-struck men will sometimes make desperate attempts, but to swim half a mile in armour was more than many could manage, and so they closed their career. I have never read Livy or Polybius since I saw the place, except an Italian translation of the former at Rome, and as I had it badly translated to me, I may say I hardly know what he says, but what I see in Lord Byron's note shows me Polybius's account is *right*, and Livy *incorrect*. So is Lord Byron, I think, in supposing the pass at *Borghetto* was occupied by Hannibal's cavalry, and that the Romans came by that Pass between the hills and the lake or by the actual high road. Had this been the case the cavalry of Carthage would have been cut off by the whole Roman Army; and if Hannibal had lost the fight, the cavalry could not have escaped—they were isolated! Again, if the Romans as he thinks came from Borghetto (or rather from above Borghetto), and were marching towards Rome, how could the position of Toro be in their *front?* it would be on their *left*, and the road to Rome before their front and open to them! In which case, although their defeat would have been very probable, it must have been on the *borders of the marsh*, to which their *rear* would

have been turned when the battle began, the flight of the discomfited Romans would therefore have naturally been by their right flank *towards Rome* by Passignano, and finally where would have been the hills to the "*right and left of the pass*" described by the *most exact of all historians*, Polybius? who wrote at the time and visited the ground, and was to all intents a General himself, for the constant companion of Scipio could scarcely be less. The way in which the relative position of the armies *appears to me*, makes Polybius clear, and seems in no way discordant with Livy, while it saves Hannibal from the blame of having exposed his cavalry to destruction, had his infantry been defeated. Placed as I believe them to have been, they did the same work, and in case of defeat would have been able to make their retreat. I should like to examine the ground at leisure with Polybius, who may always be trusted, I think, and who is proved to be far more correct than Livy in all the marches of Hannibal over the Alps.

A REVIEW OF THE IMPROVEMENTS IN MILITARY TACTICS AND FORMATIONS IN GERMANY DURING THE LAST YEAR (1873).

(*Précis of an Article from the "Militair Wochenblatt."*)

By Colonel Ouvry, C.B., late 9th Royal Lancers.

The past year may be described as rich in respect to the changes which have been made in the tactics and formations in the German Army consequent on the experiences of the last campaigns.

If we look back on the period since the Austrian campaign, we find that, beside the work of organisation, tactics also have not been overlooked or neglected; and this fact may be clearly seen—

1st. With respect to the artillery, in the employment of its masses independently on the battle-field.

2ndly. With respect to the cavalry, in the investigation of the best methods for the field organisation of larger masses and their employment on reconnaissance duties in front of an army.

3rdly. With regard to the infantry, in the introduction of changed tactical formations, and a different method of employing that arm in action, many competent judges having entertained justifiable doubts whether the old forms could be retained any longer under the new conditions of breech-loader against breech-loader.

Much has been written concerning this latter point, and much thought and calm consideration has been given to it; the result being a very general opinion that the best solution lies in *an increased employment of the loose and dispersed mode of fighting.*

In the year 1869, instructions as to the employment of troops in action, for the use of superior Officers were issued, which, although not a common property of the army, sooner or later must have exercised an influence with respect to the simplification of formations and a more general employment of the dispersed method on the field of battle.

Up to the summer of 1870, however, it cannot be maintained that these modifications, the necessity for which were so apparent and generally acknowledged, had taken root permanently in the German infantry. Troops were still skilfully manœuvred in company-columns, and the details of skirmishing were perfectly carried out, but close-order formations were most frequently employed, and volley-firing zealously maintained. Then came the war of 1870 before the Germans had time to mature and bring into operation the new regulations.

The cavalry and artillery, which had taken most serious warning from the experiences of 1866 (*vide* "Tactical Retrospect," translated by the writer of this paper) came into the field with a system of tactics which were nearly perfect, and obtained, the former in reconnaissance service, and the latter on the field of battle, the most brilliant success.

The success of the infantry, it is true, was not inferior, since the decision of most of the battles remained with that arm,—but on isolated occasions, the tenacious employment of the close-order system, as well as on other occasions, a too extensive dispersion, which rendered leading impossible (on account of the larger masses which were let out of hand) was much to be deplored.

That infantry are the chief sufferers under fire in action has always been the case since the eighteenth century, but tactical forms and methods of attacking can do much to reduce this loss to its lowest possible measure. After 1871 again, the Army did not repose upon its laurels; the reorganisation regulations, published in 1870, were promulgated and given to the infantry in 1871.

But it soon became apparent that, although these regulations contained much that was excellent in the new sense with regard to real improvement, still they were not a full and complete expression of the experiences of 1870–71. Even in 1872, in the General Order of 4th July, new experiments in battle-formations for infantry were ordered to be made.

The war had given occasion for the appearance of a flood of military literature, in which those authors who had seen actual service, although proposing various expedients, all agreed that infantry tactics, as they had been re-constituted after 1866, required further changes in the direction of a more extensive employment of the dispersed system in action, and the more frequent exercise of the same in larger masses than had hitherto been the custom.

The formations, experimentally introduced in 1872, pointed to this, and also to the best means of obviating losses, or reducing them to the smallest possible figure, as the attacking infantry during the last war had suffered most painfully on many occasions.

It was thought possible to attain towards this point, not only by a strong development of skirmishing fire, but also by deploying the supports into a second line of skirmishers, or forming them into very

small closed sections, and by the adoption of the line-formation for whole battalions in the second line, and by file-formation of the supports immediately following.

But it was lost sight of, that the premature breaking up of the supports destroyed their character as such; that the splitting them up into small sections in close order took them out of the hands of the Officers; and that file formation was no protection in presence of an oblique fire; and, lastly, that the advance by battalions in line often caused great confusion on account of the nature of the ground.

In short, in the above expedients, it was apparent that every one of them was conceived in the sense of avoidance of loss, while too little consideration was given to the preservation of a simple tactical order.

The reports of the Generals Commanding must have very generally been an expression of the above remark, for in the year 1873 all that was good in the several propositions was retained, while that which was complicated or doubtful, was struck out and rejected. The General Order of the 29th March, 1873, is about the most important progressive step in infantry tactics which has been made during the last ten years; its principles may be thus shortly expressed:—

1st. An extensive employment of skirmishers and the company-column, which are the correct battle-forms for infantry. In the first line this formation should always be resorted to. In the second line, under circumstances, company columns may be formed, but the whole or half-battalion formation may also be employed. Under an artillery fire these battalions may be deployed into line. As a rule, the skirmishers should be thrown out *per saltum*, 50—100 paces to the front at the double on the plain.

The *direct* supports can also exceptionally follow the skirmishers, either in line or in sections; to break up the real supports, and deploy them into a second line, or their formation into sections in closed order, is not admissible.

It is further laid down in the above order that a cavalry attack, *even on an open plain*, as a rule may be repulsed while keeping the line formation; still the square is to be retained (and very properly) in some measure as a reserve formation.

At the same time a number of evolutions were definitively struck out of the line exercises of the infantry, which simplified them considerably, and an injunction was added, that the formations which had been retained as necessary and efficient, should be strictly observed with the greatest nicety and exactness. There is something very encouraging, when we see the opinions of intelligent and well-instructed bodies of Officers agreeing with, and greeting with pleasure, regulations from the highest authorities, as we find the German Officers did on this occasion.

In these orders, the mode of formation and methods of fighting appear to have been laid down and indicated with the greatest clearness and perspicuity.

Certainly the paragraphs in the regulations which treat on the line of battalions and the employment of columns formed on the centre

in action were not struck out; but still it was very clear that the employment of lines of battalions in the first line of the larger divisions of troops was wholly inadmissible, and the use of the column on the centre for a direct attack was to be regarded as a rare exception, and the exercise of such attacks was to be restricted to *very short distances*. The advance also of lines of half battalions into the line of skirmishers for the purpose of delivering volleys was rejected. The advance in lines of battalions was only (as their employment in that form in two or three lines was merely admissible to protect them under an artillery fire) to be undertaken without skirmishers, and this was to hold good at all inspections.

If now we were to put the question whether the General Order was acted up to, according to its essential spirit at all infantry exercises, we hold that it could only be answered affirmatively under much reserve; according to all report, in both the greater and the smaller exercises of the infantry, the old forms were much resorted to.

Firing lines of battalions, and skirmishers kept back behind the front "at call," were also to be remarked at these exercises, as well as occasionally the employment of the column on the centre, for an attack over a long stretch of ground.

At other places the order to form company columns was formally complied with, but they were only opened out to very small intervals, apparently in order not to let them out of hand. Such an opening out as this can serve no good purpose, for the mere word of command "form company columns," is in itself no talisman against shell and shrapnel; on the contrary, such a method of dotting over the plain with a number of small columns, separated only by very short intervals, could only result in an increase of the casualties from a hostile artillery. Many are of opinion that the column on the centre should not be rejected in all cases, as soon as the troops come within the zone of the artillery fire of the enemy; the inutility, however, of such a formation became very apparent since 1866, as soon as the range of effective musketry fire was reached. We consider, in the great majority of cases, it will be sufficient if the second line moves in half battalions and not in company columns.

The opening out for action of company columns with too small intervals, has often for result the crippling the full effect of the fire of the companies in critical moments and rendering it ineffective. This proceeding, which, according to the correspondence now before us, has been very general (we speak only of exercises and not field manœuvres), clearly shows that the tactical orders of March, 1873, were formally adhered to, while, in order to bring the troops within compass of one leading, the proper spirit of the order, viz., "to develop large swarms of skirmishers, and hence great fire-power from the several company columns, was departed from.

Also the *per saltum* mode of advance did not form a prominent feature in the exercises; on the other hand, however, at the field manœuvres, battalions were seen to move *per saltum* to the front with the greatest conscientiousness whenever a cannon shot was heard at the advanced guard.

The *per saltum* (*sprungweise*) mode of advance, however, frequently means the men being blown when close up to the enemy, and it is rendered impossible by high standing crops of grain. The men also by such quick advances under such circumstances frequently would become jaded in a distant artillery fire, and the order would be loosened. On open ground, however, and in effective artillery fire, it must remain the rule.

The faulty development in the company columns which we have alluded to above, was caused without doubt by the former methods of conducting our sham fights at the greater infantry exercises. If we open out the first line of a brigade on the peace establishment into company columns, at intervals of a hundred paces from company to company, it will have a front of 1,200 paces; if six companies are deployed as skirmishers, and six remain in close order as supports, the front will extend at least 600 paces. The interposition of the supporting companies or the prolongation of the wings must, in the present times, frequently occur in order to develop the necessary fire-power, and hence we may calculate a breadth of front during the engagement of a brigade even in action, of some seven to eight hundred paces; and in this the brigade will preserve the whole second line intact. Then an objection may be taken that with such an extension of front, even at exercises, it would be impossible to command the brigade as it would be beyond the compass of the human voice; and here we see the reason which often gave rise to the crowded state of the company columns which we have alluded to. If we must still retain the deep organisation, at any rate the first line must be opened out so as to allow a full development of its fire-power.

That the dispersed mode of fighting is the one on which all our forms must be calculated, cannot be doubted; but at the same time firing from a closed mass, and the charge in the same formation must still continue to form a part of our exercises, for certain cases may occur when such forms are necessary, but the regulations should point out that these occasions are exceptional.

The following paragraphs might be inserted with benefit into the infantry regulations.

§. 1. The closed order should chiefly be employed for marching on to the field of battle, and in all movements generally under a cannon-fire; on occasions of expeditions at night time; *occasionally* against cavalry, and in the exceptional cases where the situation prevents an expeditious transition into the opened-out form; and finally by all supports of the firing-line. In this order, firing, and the attack from company-columns should be exercised, as well as from the column on the centre; but the last must be employed only over very short distances.

All acting in lines of battalions, together with attacks and volleys of the same may be entirely struck out of regulations.

2. The dispersed formation with supports in close-order, is the form chiefly to be employed by infantry; in this formation the firing will be carried out and the attack made.

3. The formation in two ranks will always be maintained.

In carrying out these formations in the exercises of regiments and brigades, we should like to see the time of the former curtailed, while that of the brigade might be prolonged.

In the so-called "rendezvous formations" the command may be carried out as formerly by the the Officer commanding, whose word of command is repeated by line and battalion-leaders; the concentration of the troops allowing the voice to be heard. The movements in this formation should be made with the greatest regularity and exactness. The Brigadier also is in a position to exercise a supervision over the whole exercise, and to observe and rectify the movements of troops, and also to form the brigade into half battalions or company-columns at *one-half or one-third* the regulated distances (intervals) so as to keep it within the compass of the voice. No looseness should be allowed during the exercise.

But when a regiment deploys for actual engagement at full distances, the command can only be exercised by means of messages through Adjutants, or orderly Officers; two Adjutants or orderly Officers should always be at the disposal of the Brigadier.

The time of a brigade exercise should be prolonged; it should not merely be allowed time to carry out the sham fight, but also preliminary elementary studies, such as the practising of the most expeditious deployments in various directions and the throwing out and change of direction of its skirmishing lines, &c.

The brigade exercises are of the greatest possible importance for the infantry, even more so than those of the Division, and more time should be given for them even at the expense of the regimental exercises, but never at the expense of the field manœuvres, which are always the practical high schools of tactics and the method of leading troops.

The protection of flanks has now assumed an increased importance, as in order to avoid as much as possible the effect of the greatly increased fire-power, an enemy will always avoid the front as much as possible, thus in simple deployments, the flanks may be re-inforced by supports, *en échelon* on their rear.

The issue of the Mauser arm has commenced, so that in the next campaign our infantry will meet the enemy on equal terms in this respect.

The cavalry reforms have been equally important. The view that the sabre is the arm which forms the essential characteristic of the cavalryman must, since the experience of 1870-71, fall to the ground. The most complete independent action for cavalry must be the watchword in the future, and to aid this *a good fire-arm must be supplied.* Frederick the Great even was not wholly opposed to foot exercises for cavalry; on the contrary all he laid down was, that while in the saddle, the dragoon should only use the sabre. As a general rule, this principle may still continue. The first cavalry leader of Germany, perhaps the first of the world, Seidlitz commenced his career by the defence of a village with dismounted curassiers.

Curassiers! and this leads to the question why not give them fire-arms the same as carbineers, and thus make them independent? It is quite impossible to foresee the conditions which may arrive in the course

of a war; we cannot know previously whether we shall only require our cavalry as mere instruments to charge the enemy in battle.

Why should we not employ curassiers as a regiment on permanent outpost service? "No sudden innovations" is certainly a maxim which holds good most particularly with regard to changes in the Army; we Prussians have obstinately held fast to those things which, in other places, have been even derided as pedantic; but here we must acknowledge that conservatism would be unjustifiable.

If we, retaining the designation, were to take away the cuirass and supply a carbine, all such regiments would be alike disposable either for the charge or independent outpost duties. We must not forget that the Seidlitzian curassiers although they had cuirasses, had only a hat on their heads; the helmet certainly appears more necessary than the cuirass, and yet what did we not do with that cavalry a hundred years ago? At the commencement of the next war, according to all probability, cavalry masses will come into contact, for most certainly the experiences made by our cavalry in 1870 will not be wholly overlooked by our enemies.

With regard to the orders promulgated in cavalry regulations of 1873, we may mention as worthy of notice:—

1st. The obligatory employment of columns of squadrons, instead of columns of troops as the proper battle columns. They can be either close, or open, at squadron distance. This formation suits itself to the inequalities of the ground, and economized space is convenient for deployments, and the form is proper for an attack.

No inversion is permissible.—The old Prussian cavalry, however, did not fear inversions. Seidlitz attacked the Russians with large cavalry masses in inverted order, and we know the brilliant success of his attack, by which the battle was won.

2nd. The attack to the front is regulated to a distance *of* 1,400 *paces including the advance at a trot.* Without doubt in the future the cavalry must be accustomed to move rapidly over long stretches of ground; but it must be remarked that all their swiftness cannot compete with the improved modern infantry fire; quick movements of cavalry may render feasable, attacks on broken infantry before they have had time to rally, but it must be borne in mind that it is only under these circumstances that the attack of cavalry is justified.

Infantry even when retreating and after they have lost their tactical order, so long as they have from five to ten cartridges left, are always in a position to resist so long as they keep their confidence and self-possession. The riding down of the French infantry at Mars la Tour does not militate at all against this. We can show against this ten other examples where the most gallant attacks of the French cavalry were repulsed by our infantry.

Maurice of Saxony required his cavalry to charge in full career over a space of 2,000 paces in the most perfect order, which is held by a most distinguished practical cavalry officer to be simply impossible.—[Clearly H. A. O.]

Here the question arises whether it is not likely that all that might be won by such rapid attacks, is not liable to be as quickly lost

by the fatigue which necessarily results from attacking over such long distances and which would render the following up of the movement impossible, so that the operation would be fruitless.

Many wise practical rules have also been laid down for attacking artillery, and if the carrying out of the same must depend in a great measure on the nature of the ground, still the impression of sound principles on really good and efficient Officers cannot be otherwise than advantageous.

The touch is laid down as "stirrup to stirrup." When this was first introduced, in 1854, it had many opponents who maintained that it was only necessary to ride thus closely at the moment of the shock in a charge, but there can be little doubt that stirrup to stirrup is the correct system.

If we now take a brief review of the balance of opinion with regard to the employment of cavalry, we see that a certain number hold that the efficiency of cavalry on the field of battle is fully re-established, and that in future all efforts should point at using that arm in the sense of the Seidlitzian or Napoleonic mass tactics. All that is required for the solution of the problem is to find the necessary capability and art of massing and directing the onslaught of large bodies of cavalry, at the proper time and place, and providing for their support; the only reason of failure hitherto has been that the efficiency of the cavalry in itself has not been such as it was of old.

[I strongly protest against this doctrine; if men and horses were of the same nature as railway locomotives, the theory might hold good. The wedge practice under the new conditions of the breech-loader, *i.e.*, the attack of cavalry on unbroken infantry as a general rule is to be deprecated.—Translator, H. A. O.]

For many reasons which would be too long to discuss here, we are not of the above opinion; our wish is to keep to the excellent cavalry tactics of 1870; why sacrifice our fleet and glorious array of cavaliers—the eyes and the ears of our hosts, under whose watchful clouds we calmly assemble new forces, either for the toilsome march, or the bloody wager of the battle? why immolate them, by demanding from them the impossible, thereby depriving ourselves of the old "veil" which they spread before our ranks? if a victim should be actually required, reserve it for a moment, such as that of Vionville when such a sacrifice was a dire and indispensable necessity.

But if we do not agree with those who we consider as hot-headed theorists, concerning this employment of our cavalry, there can be no doubt that we should exercise and teach the cavalry to move in large masses, which, on account of its great difficulty, is so much the more desirable. The occasion for sacrifice like that of Vionville may occur again.

There can be no doubt that cavalry manœuvres on a large scale should form a part of the annual exercises.

In infantry, the time of action in battle is comparatively long, while that of cavalry is usually confined to very short periods, hence more can be learnt at exercises on a large scale by cavalry, *i.e.*, the exercises are more useful to cavalry than infantry.

The success of the cavalry in the Seven Years' War, in the opinion of many, greatly depended on the rapid rallying after a charge, and the repeated renewal of the attack by hurling the re-formed masses against the enemy.

No doubt the cavalry exercises in large masses without infantry has its disadvantages, inasmuch as it would be better to have infantry present than to have them supposed.

In cavalry brigade exercises, care should be taken not to be led away by the theories of hot-headed young men to venture on inconsiderate attacks with single squadrons upon unbroken infantry.

The artillery received guns of a different calibre in 1873. Their tactical behaviour at the field-manœvres was generally appreciated; but occasionally they were said to have approached their guns too near to the enemy, and brought themselves for a lengthened period under musketry fire; but it is better to err a little in this respect than to revert to the tactics of former times.

For Officers, on command from the infantry to the pioneers, simplified instructions have been issued. Occasionally, on suitable occasions, instructions might be given to throw up a field work or fortify a post.

Such are some of the novelties which have been introduced in 1873, it remains for the Army to apply them—all depends on the zeal and diligence of the Officers to carry out that which has been laid down by superior authority. Genius and natural gifts, no doubt, play a conspicuous part in all human undertakings; still it is not less true, that diligence and assiduity go half way towards winning the battle.

H. A. O.

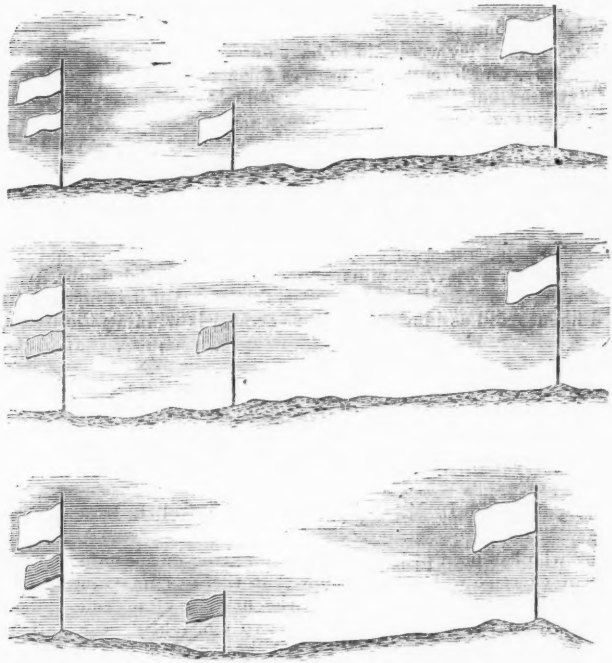
ARTILLERY-FIRE IN PEACE-MANŒUVRES.

By Captain L. M. Carmichael, 5th Royal I. Lancers.

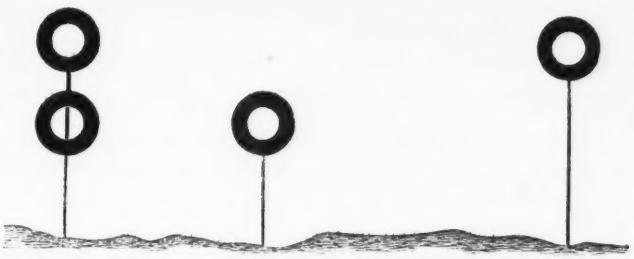
Anyone who has been present either as an actor or spectator at recent camps of exercise will acknowledge that there is no point in which some change is more needed than in the manner of making artillery-fire known to the objects of it. I have constantly heard artillery Officers, at the discussion which often follows a sham fight, assert that they had fired on for long periods, and annihilated bodies of troops, whose Commanders have then and there stated they never saw, sometimes never heard the guns in question, and were quite unconscious that they had been the objects of their special attention.

Latterly, umpires attached to batteries have had it impressed upon them that they or their gallopers should always ride and inform bodies of troops who appeared unconscious they were under fire, that they were being fired upon, and could not remain in their present position. But to ride 2,000 yards to make a communication which is never received with exuberant gratitude, is not a pleasant task; and it is not surprising that it is far less often attempted than it ought to be.

In the month of April, 1873, after the Hussun Abdul Camp, I suggested in an Indian newspaper a scheme by which Artillery Officers might have it in their power to say, "I am firing at you," and by which the troops fired at could discover they were being fired at without any fatigue to umpires or their horses. I proposed that each half battery should have one long white, and three short flags—white, red and blue; and that by a system of aligning one short flag of the three colours on the long flag, the particular class of troops fired at might be informed that they were under fire.



Last winter, at the Roorkee Camp, I saw tried on the last day of the manœuvres, a system—of which I believe Captain Barnes, 10th Bengal Lancers, is the author—by which, by aligning two large circular discs on the troops, the same result was arrived at. But in Captain Barnes' system there was no attempt to distinguish the class of troops fired on; the general direction of the fire only was indicated.

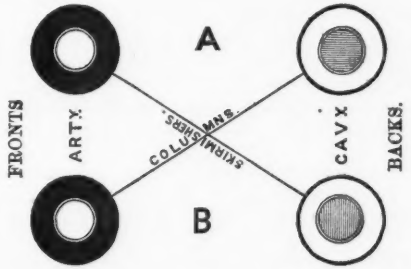


I think, however, that it is very necessary that the particular kind of troops fired on, should be shown. Skirmishers may be in front with guns firing over their heads, and behind the guns columns of either cavalry or infantry all in one line; and it is scarcely fair that artillery should get the credit of firing on all three at once.

But I think discs, although not so portable as flags, have an advantage in being superior to the direction of the wind, and having two sides, fewer articles require to be carried.

The system I am now about to propose combines, I think, the advantages of both schemes, and completely fulfils its object.

I propose that each half battery should be provided with two large discs of canvas, which I shall call A and B. The poles of these should be of different lengths; for when aligned on an object on such level ground as occurs on the plains of India, it would be difficult, if both were of the same length, to separate the discs.



The front of both discs should be a black outer with white centre.

The back of A, white outer and blue centre.

The back of B, white outer and red centre.

The battery, on coming into action, aligns the two discs on the object of its fire, adapting the long and short staff to the ground, so as to bring the discs, although separate, reasonably near each other.

Against artillery, I propose to show two fronts to the enemy, who will then see this: two white centres.

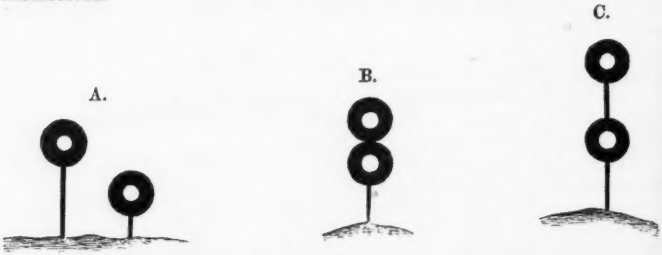
Against cavalry, I propose to show two backs to the enemy, who will see this: two dark centres.

Against deployed lines of infantry, front of A and back of B: white and red.

Against columns of infantry, front of B and back of A: white and blue.

I do not propose in these two last positions to have white necessarily uppermost, because the ground might be such as to make it more convenient at different times to have the long pole in front; and *vice versâ*.

It is evident that a body of troops advancing against a position seeing the discs thus (A), need trouble their heads no further about the matter. Whoever was being fired at, they would know it was not themselves.

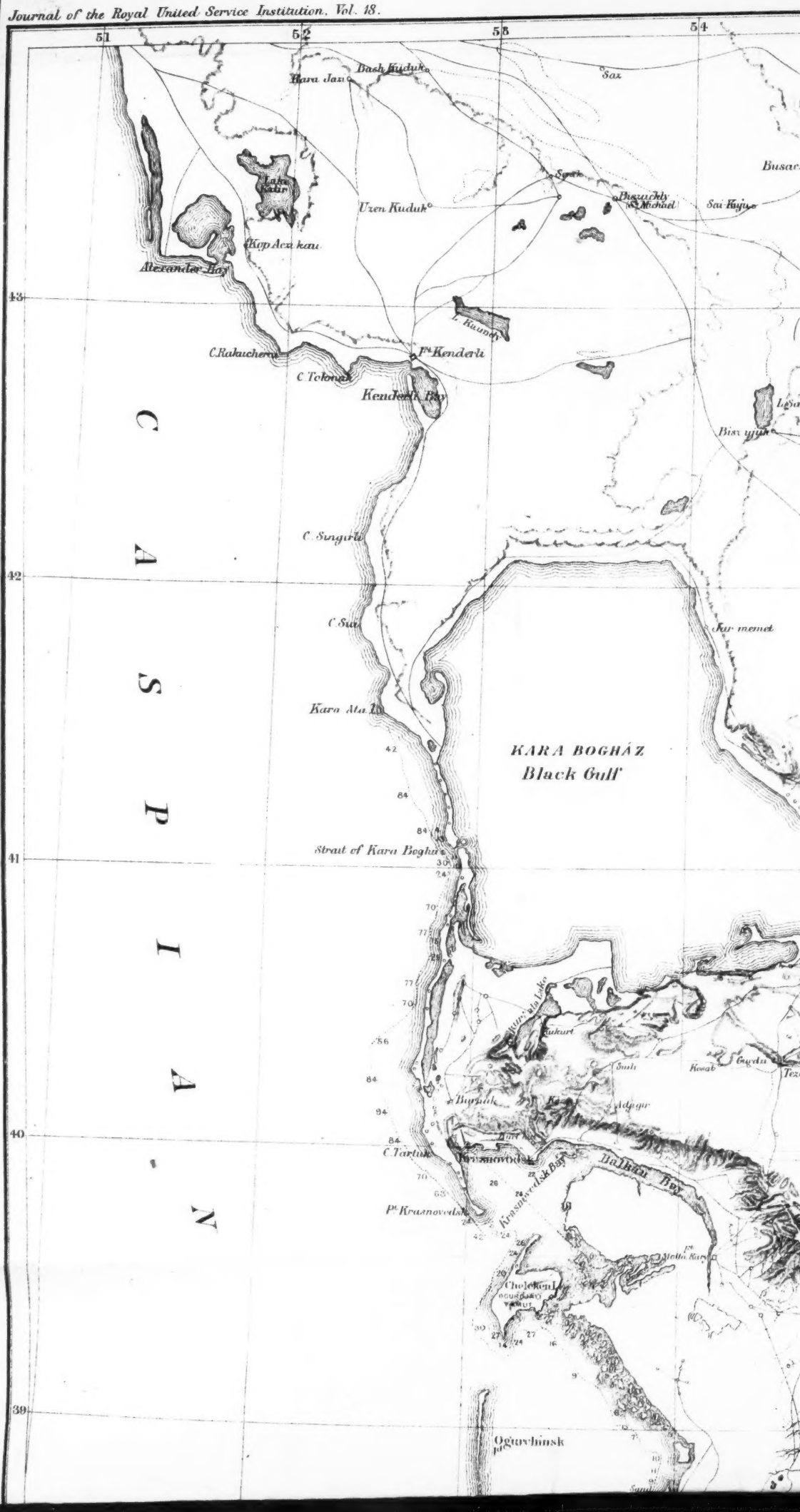


But, either in motion or at rest, if (B), or (C), appeared, it would be for the Umpire to inform the Officer commanding, of the fact, and later, of course, come to any decision which that Officer's dispositions under fire might render advisable.

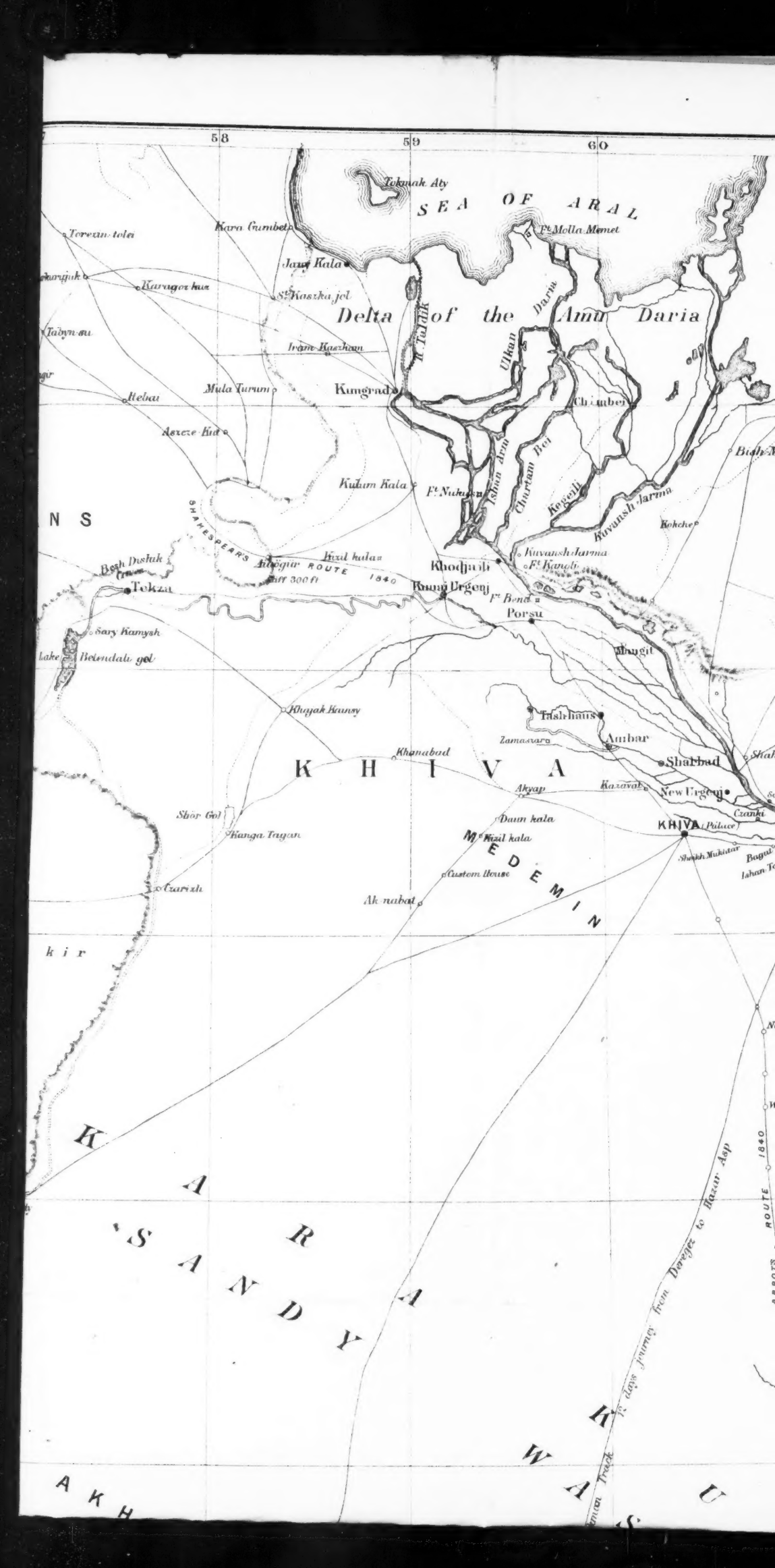
A system such as I advocate may also prove very useful when skeleton enemies are employed. A certain number of flags or discs may represent a certain number of guns; and their raising or lowering, the commencement or cessation of fire; the change in their alignment and colouring, the change in the direction and object of their fire.

When there are guns—but when it is not desired to expend much ammunition—one round per gun might be fired to give warning on first opening fire, or on any change of the direction of the discs or flags.

I have not discussed the actual size of the discs, or the length of the poles, as this is a matter of detail, which can be best arrived at by experiment, and also does not affect the principle of the scheme.


51
52
53
54
Hara Jan
Bash Kuduk
Saz
Uzen Kuduk
Alexander Bay
Kenderli Bay
C. Singurli
C. Sur
Kara Ata
KARA BOGHÁZ
Black Gulf
Strait of Kara Boghaz
C. Tarkut
Krasnovodsk Bay
Balkan Bay
Ogurchinsk
43
42
41
40
39
CASPIAN

55
56
57
58
Kazan Kuduk
Kosz jatar
Sapah
Jarkymbaj
Suks
Sapak
Busarzn
Kuruk
Kynyr
Jol Jitirgen
Kurkurguk
Karagor kuz
Torexin tolei
Sai Kuju
Sunia Temir
Tabyn su
Ittedza
Baitur
Kizil Agir
Sagir
Itebai
UST URT
(High Plateau)
ABBOT'S ROUTE 1840
Asrete Kul
Le Salz
Biri yuk
CHAUDOR TURKMANS
Tekza
Padsere Aksaj
Karakan
Sary Kamysh
lake Beiendali gol
Bairam dt
Kar memet
MURAVIEFF'S ROUTE 1822
Kum kuyo
Shör Gol
Kazakly
Depne
Kum Sebsheu
Tonüklu
Uch Ata
Karaman
Kaplan kir
Tuun
Doungra
VAMBERY'S ROUTE 1863
Kenal
Tezli ata
CHIN MUHAMMAD KUM
Alty Kujuruk
Igdy
Old Bed of the Amu Daria (Oxus)
Toshaluu
Chalet
Little Balkan
Kizil Arvat
Kara Singer
KASA
AKH


58
59
60
SEA OF ARAL
Tokmak Aty
Kara Gumbet
Ft Molla Memet
Jany Kala
Delta of the Amu Daria
R. Tuzluk
Ulkan Daria
Kungrad
Chimbei
Mula Turum
Mebai
Asreze Kui
Kulum Kala
Ft Nukuska
Ishan Ata
Churtam Bei
Kegeili
Kuvansh Jarma
Kokche
Khodjuili
Kuvansh Jarma
Ft Kanegli
Kunia Urgenj
Ft Bend
Porsu
Tekza
Bash Dushak
Sary Kamysh
Lake Beiendali gol
Khojak Kaunsy
Tashhauz
Amber
Zamasaro
Khanabad
K H I V A
Sharbad
Akyap
Kazavat
New Urgenj
Czarku
KHIVA Palace
Daun kala
Kizil kala
Custom House
Shor Gol
Kianga Tagan
Ak nabat
MEDEMIN
Sheikh Mukdar
Bagat
Ishan Ta
k i r
K A R A 'S A N D Y A K W A S U
AKH
Kizil kala
Ft Molla Memet
Kara Gumbet
Jany Kala
Kungrad
Khodjuili
Kunia Urgenj
Porsu
Tekza
Bash Dushak
Ft Bend
Ft Kanegli
Kuvansh Jarma
Kokche
Chimbei
Ft Nukuska
Kulum Kala
Asreze Kui
Mula Turum
Mebai
Kegeili
Churtam Bei
Ishan Ata
Ulkan Daria
R. Tuzluk
Tokmak Aty
Torean tola
Karagoz kua
St Kaszka jol
Irgiz Kazkan
Tabyn au
Khojak Kaunsy
Sary Kamysh
Lake Beiendali gol
Shor Gol
Kianga Tagan
Ak nabat
Czarku
Khanabad
Zamasaro
Amber
Tashhauz
Sharbad
Akyap
Kazavat
New Urgenj
Czanka
KHIVA Palace
Daun kala
Kizil kala
Custom House
Sheikh Mukdar
Bagat
Ishan Ta
Khiva Track
Kizil kala
Ft Molla Memet
Kara Gumbet
Jany Kala
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Kunia Urgenj
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Bash Dushak
Ft Bend
Ft Kanegli
Kuvansh Jarma
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Ft Nukuska
Kulum Kala
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Mula Turum
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Ulkan Daria
R. Tuzluk
Tokmak Aty
Torean tola
Karagoz kua
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Khojak Kaunsy
Sary Kamysh
Lake Beiendali gol
Shor Gol
Kianga Tagan
Ak nabat
Czarku
Khanabad
Zamasaro
Amber
Tashhauz
Sharbad
Akyap
Kazavat
New Urgenj
Czanka
KHIVA Palace
Daun kala
Kizil kala
Custom House
Sheikh Mukdar
Bagat
Ishan Ta
Khiva Track
SHAHESPEARS ROUTE 1840
Kizil kala
Ft Molla Memet
Kara Gumbet
Jany Kala
Kungrad
Khodjuili
Kunia Urgenj
Porsu
Tekza
Bash Dushak
Ft Bend
Ft Kanegli
Kuvansh Jarma
Kokche
Chimbei
Ft Nukuska
Kulum Kala
Asreze Kui
Mula Turum
Mebai
Kegeili
Churtam Bei
Ishan Ata
Ulkan Daria
R. Tuzluk
Tokmak Aty
Torean tola
Karagoz kua
St Kaszka jol
Irgiz Kazkan
Tabyn au
Khojak Kaunsy
Sary Kamysh
Lake Beiendali gol
Shor Gol
Kianga Tagan
Ak nabat
Czarku
Khanabad
Zamasaro
Amber
Tashhauz
Sharbad
Akyap
Kazavat
New Urgenj
Czanka
KHIVA Palace
Daun kala
Kizil kala
Custom House
Sheikh Mukdar
Bagat
Ishan Ta
Khiva Track
SHAHESPEARS ROUTE 1840
Alt 300 ft

61
62
63
64
Omer Hasgan
Ft. Dzartuse
Ivvibay
Bed of the Amu Daria
Kokdje (sweet water)
Kizil bak
Tasr molasy
43
Bibi Mazar
Ankardy bulak
Ihz Kuduk
Dort Kudak
Kaphantash
Myn bulak
Bizekly bulak
Yuz Kuduk
42
Kokche
Chukilak
Kosar
Tobdik
Adin bai
Kendzaryk
Shah Abbas Wali
Said Mirei
Shurakhan
Petrovsk Alexandrovsk
Czarki
Ak Kamysh
Palace
Kurdly
Ft. Mangakli
Bagat
Ishan Tchopa
Bazar Asp
Fitneh Vil.
BAT KAK KUM
Marshy Sands
Chalata
41
Uch agach (3 trees)
Muzar Kuduk
Nine wells
Dari
Akhrabat (ruins)
Deveh Boyun
Bazral Madar & Baba Adam
High mound
Kukertli
Akhrabat
Wells of brackish water
KHALATA CHOLI
Sagri
Kyz kala
40
Ft. Ighdi Kabakli Tepeh Kalah
Nemekabad
Uch Ijak (3 houses)
Well-water abundant but bitter
Shukshuk (Vambery)
Nargiz
Ft. Kara kol
Sel Herak
Ft. Chandyr
Abdul
Takht-i-Suliman (A large sand hill) W.
Hodga Ipse
Uzlyk
Kusuk
Belik River 650 yards wide 39 feet deep
Chushmah or The Spring abundant well of pure water in dry bed
Chardjui
Here navigation commenced Burnes Vol II p5
39
Kulta Mines
Shurkan
Well
Rah i dibbi
Tik Robats
Ferâul
AMU DARIA
OXUS
ABBOTS ROUTE 1840
BAZAR ASP 1840
SHAKESPEARS ROUTE 1840
LOVE THOMSON 1842

A MAP OF
THE NORTH EASTERN FRONTIERS OF
PERSIA
EMBRACING ALSO KHIVA & THE INTERVENING DESERTS

G R E

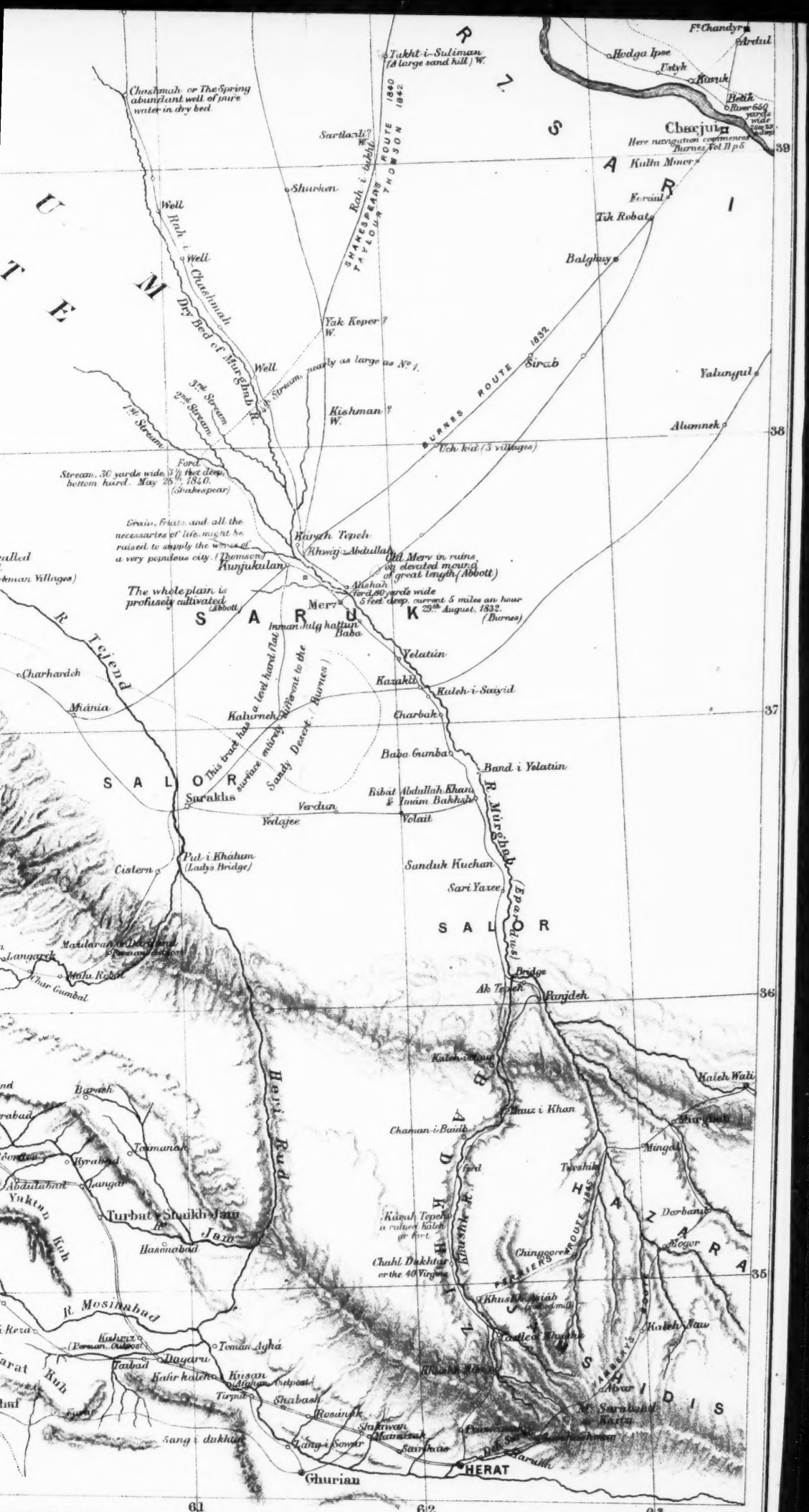
Compiled from the Surveys and observations of
Col[o] Valentine Baker & Lieut[t] W.J.Gill.R.E.
together with the recent Russian Surveys and all other available documents.

Scale of English Miles.
10 0 10 20 30 40 50 60

52° Longitude E. of Greenwich 53 54

Kizil Arvat
AKHAL
YAMUT
GOKLAN
JAFARBAI YAMUT
Kara Sanger
Kizil Chesmeh
Beurma
Achma
Sutchu
Bishagan
Karriz
Road from Dewan
Mt Parvar
Mt Kodak
Mt Kara Kodak
Mt Hurrah
Mt Gergal
Mt Marica
Mt Kara Tepe
Mt Kara Kuh
Mt Kara Kuh
Mt Kara Kuh

AKHAL TEKEH
KARAKUM WASTE
Turkman Track
½ days journey
Swamp
Place called Tejend (Turkman Villages)
Askubat
Kuchan
Muhammadabad
Kilat
Bam
Abdullah gaut
Lenglcar
Saidan
Ameerabad
Kardan
Chushmashe
Lubinabad
Kabud
Sabzawar
Nishapur
MASH-HAD
Ghuicken
Langarh
Tangalstan
Shahrabad
Salt Desert
Behngan
Kehrizdameh
Farahabad
Kadamderabad
Fakhrabad
Rumari
Shurhasar
Kaleh
Mimri
Abdulabad
Yuktan Kuh
Turbat-i Haidari
Turshiz
Himatabad
Miandeh
Sangun
Karat Kuh
Khaf
Bajistan
Juwain
Kuh i Ratnawak
Naudpushan
Kashrud
Kuh
Chah
Kuma
Dunargh
Kishtaar
Nasirabad
Salamat
Aeudabad
Kuh
Kuh
Kuh



Stanfords Geog. Estabt. Charing Cross, London.